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Incidence And Risk Factors Associated with Surgical Site Infection in Oral Squamous Cell Carcinoma Patients-A Single- Center Prospective Study

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ABSTRACT

Introduction: Surgical management for head and neck cancer frequently entails a multi-step, intricate process that includes substantial resections, significant neck dissection and vascularised tissue repair. Surgical site infection (SSI) is a significant complication arising in patients undergone surgery for oral squamous cell carcinoma, impacting recovery and clinical outcomes. Our objective is to evaluate the prevalence of surgical site infection (SSI) and the risk variables related to it in patients who have undergone major surgery for head and neck cancer. **Materials and methods:** This is a prospective observational study which included 60 patients who underwent surgery. Surgical procedure included wide local excision, neck dissection with or without flap reconstruction. All the patients received intravenous antibiotics cephalosporins and metronidazole for 5 days postoperatively, and were observed for minimum of 30 days for any postoperative infection. Patient demographics, clinical data, perioperative variables were collected including age, sex, tumor stage, comorbidities, surgical procedure, history of prior radiotherapy, duration of surgery and postoperative care. The incidence of SSI was recorded and potential risk factors were analyzed. **Results and discussion:** In our study patient's average age is 56.13±8.90 years. Twenty of the sixty patients developed surgical site infection (SSI). Tumour stage, ASA classification and the occurrence of surgical site infections are statistically correlated. The majority of individuals have tumours in advanced stage- IV. Although, the development of surgical site infections and tumour stage do not correlate statistically (p=0.120) but higher stage of disease have poor prognosis and predispose to SSI. Prior radiotherapy and tracheostomy shows no statistical correlation. However, Reconstruction with flap is statistically significant with Surgical site infection (p=0.016). **Conclusion:** After obtaining results, it is concluded that incidence of SSI remains a concern, with multiple factors contributing to infection risk. Early identification and targeted management of patients having comorbidities, undergone radiotherapy and planned for reconstruction can help reduce the incidence of surgical site infection and improve surgical outcomes.

Keywords: Incidence**,** Oral squamous cell carcinoma, flap reconstruction, Surgical site infection, Risk factors

INTRODUCTION

Oral cancer, a subtype of head and neck cancer, is becoming more and more of a global public health concern. It

ranks 16th in the world's cancer death list. Malignant tumours of the oral cavity, including secondary locations inside the oral cavity, are referred as oral cancer. [1] Oral squamous cell carcinoma (OSCC) is the term used to refer to tumours originating from squamous epithelial cells. [2,3] Squamous cell carcinoma is the most prevalent cancer in the oral cavity and in the top 10 most common cancers globally. [4,5] The global age-standardized incidence rate of oral and oropharyngeal cancer was estimated by Global Cancer Statistics (GLOBOCAN) to be roughly 6/100,000 in 2020. [6] Major oral oncological surgery involves disruption of mucosal lining and bacterial contamination which frequently results in surgical site infection (SSI), which is defined as an infection in a surgical wound developed within 30 days following surgery. [7,8] The process of infection, in which bacteria interact with the host, is influenced by a number of factors. [9] The incidence rate of SSI in patients with oral cancer after major surgery has been found to range from 10% to 45%. [10,11] When SSI occurs, it delays healing that can result in wound breakdown, fistula formation, flap loss which raises the possibility of re-surgery. [12,13] As a result, there may be significant functional morbidities including poor quality of life, poor speech and swallowing ability and poor aesthetic outcomes. [13] Moreover, SSI raises healthcare costs and lengthens hospital stays. [13] Numerous risk variables have been documented in earlier research. SSI was found to be associated with various factors, such as diabetes mellitus, smoking, prior radiotherapy, surgery, chemotherapy, poor physical status score from the American Society of Anaesthesiologists, hypoalbuminemia, perioperative blood transfusion, tracheostomy, clean-contaminated wounds, length of preoperative hospital stay, lymph node metastasis, and reconstruction using myocutaneous flaps or microvascular-free flaps. [12-15] The anatomical quirks of oral cavity increases the difficulty and risk of the procedure and raise the possibility of post operative complications. [16] Our goal is to evaluate the prevalence of surgical site infection (SSI) and the risk variables related to it in patients who had major head and neck cancer surgery.

MATERIALS AND METHODS

This is a prospective observational study which included 60 patients who underwent oncology surgery from September 2023 to March 2024. Surgical procedure included wide local excision, neck dissection with or without flap reconstruction. All the patients received intravenous antibiotics cephalosporins and metronidazole for 7 days postoperatively, and were observed for minimum of 30 days for any postoperative infection. The potential risk factors like co-morbidities (ASA Classification), tumor staging(I-IV), prior radiotherapy, need for tracheostomy, type of reconstruction, requirement of re surgery were assessed. Patients with oral squamous cell carcinoma who had undergone surgery and had any indications of infection were among those we considered. Patients diagnosed with SSI, cultures were sent and evaluated for sensitive drugs. Prior to surgery, individuals with active infection or those receiving antibiotic therapy were excluded. Ethical clearance was taken from The Saveetha Dental College & Hospital institutional Human Ethical committee (SDC-IHEC), IHEC-Reference Number: IHEC/SDC/OMED-2303/23/140.

STATISTICAL ANALYSIS

All statistical analysis were performed using SPSS ver. 22 (SPSS, Inc., Chicago). There were documented demographic variables. Data entered into Microsoft Excel was examined. Statistical analysis is done using software SPSS. The data were described using descriptive statistics for categorical variables and methods including frequency analysis, percentage analysis, mean, and standard deviation for continuous variables. The significance of the category data was determined using the Chi-Square test. The probability value of 0.05 is the definition of the significant level.

RESULTS

According to the age distribution of the study population, the age range of the majority of the patients in our study is 40 to 60 years old. Our study's patients average age is 56.13±8.90 years. 14 patients were female, and 46 patients were male overall based on gender distribution. This data suggests that men have a higher tendency than women to develop oral cancer. Twenty of the sixty (30%) patients experienced a surgical site infection (SSI).

Prior to surgical procedure, a patient's health status is assessed using the physical status classification system created by the American Society of Anaesthesiologists (ASA). The objective of the ASA categorisation system is to keep a record of the patient's health prior to surgery. In our study, 17 patients (28.3%) were in the ASA II classification, of which 2 patients experienced an SSI; 42 patients (70%) were in the ASA III classification, of which 17 patients experienced an SSI; only one patient in ASA IV developed SSI. The likelihood of developing SSIs escalates with an elevated ASA score, particularly in individuals with comorbidities such as diabetes and

hypertension (ASA III). Tumour stage, ASA score and the occurrence of surgical site infections are statistically correlated. A statistically significant result was shown by the chi square p value of 0.038. Regarding tumour staging, only one patient (1.7%) has a stage I tumour, eleven patients (18.3%) have a stage II tumour, nineteen patients (31.7%) have a stage III tumour, and the other twenty-nine patients (48.3%) have a stage IV tumour. The majority of individuals have tumours in stage IV and developed SSI. Although The development of surgical site infections and tumour stage do not correlate statistically (p=0.120), but shows greater inclination (Table-1).

Table 1: ASA Classification and tumour staging

ASA & Staging	**ASA**		**Tumour Staging**	
	No of patients (n=60)	**(%)**	**No of patients (n=60)**	**(%)**
I	0	0	1	1.7%
II	17	28.3%	11	18.3%
III	42	70%	19	31.7%
IV	1	1.7%	29	48.3%

According to our study, prior radiotherapy, 11.7% of the patient had undergone 50gy of radiation, 3.3% of the patient had 50gy radiotherapy+chemotherapy and 85% of the patient had no radiation. There is no statistical (p=0.732) relationship between prior radiotherapy and SSI development (Table-2).

Table 2: Comparison of incidence of SSI with prior radiotherapy

Prior radiotherapy	**No of patients (n=60)**	**SSI (%)**
		Yes (%)
50 gy	7 (11.7%)	3 (15%)
50 gy+ chemo	2(3.3%)	1 (5%)
No radiation	51(85%)	16 (85%)
Total	60	20
		P value = 0.732

Table-3 Compares the incidence of SSI with the length of surgery in hours. The mean length of surgery among those who suffered from SSI was 8.10 hrs and the mean length of surgery among those who did suffer from SSI was 7.18 hrs, the difference however was not significant.

Table -3- Comparison of incidence of SSI with length of surgery

SSI	Mean length	SD	Difference	p-value
Yes	8.10	1.33	0.92	0.067
No	7.18	2.50		

Following tumor excision, some patients were planned for reconstruction using flaps 4 (6.7%) underwent myocutaneousfree flap reconstruction, and 39 (65%) underwent myocutaneous pedicle flap reconstruction; of these, 18 patients experienced SSI. One patient (1.7%) underwent osteocutaneous flap repair, whereas one patient (1.7%) underwent regional flap reconstruction. Fifteen patients (25%) did not require reconstruction. A statistically significant result was shown by the P value (p=0.016) (Table-4).

Table-4: Incidence Reconstruction with Flap

Reconstruction with Flap	**SSI**		
	Yes (%)	**No (%)**	**Total No of patients (n=60)**
Myocutaneous free flap	0	4 (10%)	4 (6.7%)
Myocutaneous pedicle flap	18 (90%)	21 (52.5%)	39 (65%)
Osteocutaneous flap	1 (5%)	0	1 (1.7%)
Regional flap	0	1 (2.5%)	1(1.7%)
No reconstruction	1 (5%)	14 (35%)	15(25%)
Total	**20**	**40**	**60 (100%)**
P value	0.016		

In our study, two patients underwent tracheostomy, following surgery.Among the patient who underwent tracheostomy one patient and who doesn't undergo tracheostomy nineteen patients developed SSI (Table-5).Seven of the twenty patients who developed SSI required surgical re exploration.

Table 5: Incidence of SSI and Tracheostomy

	Tracheostomy		**SSI**
	No of patients (n=60)	**(%)**	
NO	58	96.7%	19
YES	2	3.3%	1
Total	60	100%	20
			P =1.000

DISCUSSION

As a primary consequence of major oral cancer surgery, surgical site infection raises the risk of postoperative morbidity, delays wound healing and adjuvant therapy, increases treatment costs, and lowers quality of life. [13] The literature suggests that the range of incidence of infection after repair and reconstruction is between 15.0% and 26.1%. [17, 18] It is essential to recognise possible risk factors and implement suitable preventative measures in order to avoid SSI. The majority of patients undergoing oral and maxillofacial surgery require tracheal intubation under general anaesthesia, with the patient's oral or nasal cavity serving as the intubation site. The microbiological balance in the oral cavity may get disturbed by the reconstruction and repair procedures. Additionally, the oropharynx and respiratory tract are connected to the oral cavity, and the warm, moist physiological environment of the nasal and oral cavities makes it conducive to the growth of bacteria. [19]

Our study's average patient's age is 56.13±8.90 years. The incidence of SSI reported in our study is 33.3%.

Average age was
55.63 years
Average age was
55.63 years
Average age was
55.63 years

In our study increased age increases the risk of SSI and there is statistical correlation between ASA and SSIs. Advanced age and poor ASA physical score should be carefully weighed for every surgical intervention.

Our study results showed that there is a correlation between ASA and SSI. The frequency of postoperative infection is highly correlated with ASA grading, as demonstrated by a prior study. [20] Radiation therapy, used as an adjuvant therapy for oral cancer, destroys malignant cells while also harming healthy tissues; salivary gland dysfunction, hypo-vascularity, decreased cell renewal which can lead to compromised wound healing. [26] Although, Our study results showed there no direct association between priory radiotherapy and SSI. The question of whether preoperative radiation therapy can affect postoperative infections on its own is still up for debate. Research by Girod et al. [21] and Penel et al. [22] found no connection between preoperative radiation and postoperative infection in patients, regardless of radiation therapy; however, research by Ogihara et al. [23] and Gan et al. [24] suggests that preoperative radiation therapy raises the risk of postoperative infection in patients. In Shi M et al (2020) [25] study, patients who had previously received radiotherapy had a 58.33% (seven out of 12 patients) likelihood of getting SSI, indicating that radiotherapy history is a separate risk factor for SSI. Patients with oral cancer are frequently treated with tracheostomy to avoid suffocation from airway obstruction during or following surgery. Numerous earlier studies have demonstrated a substantial correlation between tracheostomy and SSI. [12,13, 27,28] Additionally, patients who had tracheostomies had a two-fold increased risk of SSI compared to those who did not, according to the Shi M et al study. [25] The surgical wound being visible to the skin or a persistent contact between the respiratory tract and the wound could lead to potential contamination through tracheostomy.

Studies focus on patients undergoing major ablative surgery for oral squamous cell carcinoma management, with a substantial percentage of patients requiring vascularised flap reconstruction. Specifically, Myocutaneous free flaps are correlated with wound infections compared with no flap reconstruction. [29] After obtaining results, it is concluded that extreme care should be taken in the patients present with comorbidities, had undergone radiotherapy and planned for reconstruction to avoid surgical site infection.

CONCLUSION

These new results suggest that individuals with comorbidities- diabetes mellitus, those who have had radiotherapy in the past, those who have had a tracheostomy, and those who have had flap repair are at higher risk of SSI. As a result, individuals who have these risk factors might need careful postoperative observation for any signs of SSI. Theoretically, patients with oral cancer would have better surgical outcomes if these risk variables were effectively managed.

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