Understanding Surgical Site Infection in Post Operative Patients of Oral Squamous Cell Carcinoma: Causative Organisms and Antibiotic Sensitivity Patterns – A Prospective Study

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KEYWORDS
Oral Squamous Carcinoma, Surgical Site Infection, Postoperative, Causative Organism, Antibiotic Sensitivity

ABSTRACT
Introduction: Patients with oral cancer are more likely to experience surgical site infection. SSIs following head and neck cancer surgery can occur in as many as 10–45% of cases, even with antibiotic treatment. Numerous studies have demonstrated the importance of Staphylococcus aureus as a pathogen in surgical site infections (SSIs) after head and neck surgery. Our goal was to comprehend the causative organisms and antibiotic sensitivity patterns associated with surgical site infection in postoperative patients with oral squamous cell carcinoma.
Materials and methods: This is a single Centre prospective study over a period of 12 months. Patients undergone surgery for oral squamous cell carcinoma were monitored for up to 30 days for any sign of infection development. Wound swabs were collected from infected sites and sent for microbiological analysis. The isolated organisms were identified using standard biochemical tests. Antibiotic sensitivity testing was performed using the Kirby-Bauer disk diffusion method.
Results: Surgery was performed on 80 patients for oral squamous cell carcinoma. Out of which 30 patients developed signs of infection. Majority of the patients in our study aged between 40 to 60 years. An extraoral neck wound was identified as the most frequent site of infection. Nearly, half of the patients in our study were infected with Pseudomonas aeruginosa. Least of them infected with Enterococcus faecalis and Escherichia coli. The most sensitive antibiotic drug against microorganism was found to be piperacillin.
Conclusion: Early detection of bacterial infections and the use of a potent antibiotic against the pathogen are essential for the successful treatment of patients with surgical site infection. Antibiotic use in court is also crucial to preventing the emergence of drug resistance.

1. Introduction:

Head and neck cancers account for about 650,000 cases and around 330,000 deaths yearly, making them extremely important to public health [1]. The tumours that affect the oral cavity, throat, nasal cavities, paranasal sinuses, ear, orbit, scalp, and salivary glands are referred to as head and neck cancers [2]. The location of these malignancies affects higher functions like speech, hearing, vision, smell, and taste as well as some of the most fundamental ones like breathing and swallowing [3]. Surgical site infections (SSIs) account for 20% of all infections related to healthcare and are one of the most dangerous post-operative consequences [4].
Compared to surgeries in other anatomical sites, the frequency of this complication is higher in patients with cancer of the oral cavity due to the exposure of the surgical site to oral bacteria and the necessity of reconstructing the oral cavity's mucosal barrier after surgery, especially in cases where there is a communication into the neck.
Even with antibiotic prophylaxis, SSIs after head and neck cancer surgery may happen in as many as 10–45% of cases. Serious side effects, including sepsis, mucocutaneous fistulae, and wound dehiscence, can also result from the development of SSIs. In addition to poor cosmetic results, delayed oral intake, and delayed adjuvant therapy, delayed wound healing can also occur [5].
Co-morbid illnesses like diabetes, advanced age, obesity, smoking, advanced stage tumor, and compromised immune systems are among the risk factors for infections.
According to the Centres for Disease Control and Prevention, surgical site infections (SSIs) are defined as infections that occur within the first 30 days following surgery and involve at least one of the

following factors: purulent drainage, positive culture, intentional incision and drainage, or the presence of signs and symptoms [6].

Many studies have shown that Staphylococcus aureus is a significant pathogen in surgical site infections (SSIs) following head and neck surgery [7,8]. The majority of surgical site infections (SSIs) following head and neck surgery result from endogenous flora that is either skin- or aerodigestive tract-resident [9]. Decolonisation using topical antibiotics is one of method used to reduce the risk of SSIs. Topical antibiotic mupirocin is effective against most staphylococci and streptococci, but less effective against anaerobes and Gram-negative bacilli [10]

The information from our study may aid in the decision-making of clinicians regarding surgical wound sepsis-related infection control and prudent antibiotic use.

The study's objectives are to identify the microorganisms linked to SSIs and their susceptibility profile, as well as to evaluate the pattern of post-operative wound infections in patients with head and neck cancer.

2. Materials And Methods:

This prospective study was conducted in Department of oral and maxillofacial surgery, Saveetha Dental college and Hospital, Vellapanchavadi, Chennai, Tamil Nadu, India. It a single centre study over a period of 10 months from January 2024 to October 2024.. Patients undergone surgery for oral squamous cell carcinoma were monitored for up to 30 days for any sign of infection development. Pus swabs were collected from infected sites and sent for microbiological analysis. The isolated organisms were identified using standard biochemical tests. 'Antibiotic sensitivity testing was performed using the Kirby-Bauer disk diffusion method, with a focus on commonly used antibiotics. We included patients diagnosed with oral squamous cell carcinoma has undergone surgical treatment and developed signs of infection. We excluded patients with pre-existing infections or on antibiotic therapy prior to surgery.

The main outcome was the causative organism of SSIs and antibiotic sensitivity. The Saveetha Dental College & Hospital institutional Human Ethical committee (SDC-IHEC) approval was obtained for our study, IHEC-Reference Number: IHEC/SDC/OMED-2303/24/160.

3. Statistical Analysis:

Demographic variables were recorded. Information input into Microsoft Excel was checked. SPSS software was used for statistical analysis. For continuous variables, methods such as frequency analysis, percentage analysis, mean, and standard deviation were employed; for categorical variables, descriptive statistics were used to describe the data. The Chi-Square test was utilised to ascertain the relevance of the categorical data. The significant level is defined as the probability value of less than or equal of 0.05.

4. Results:

A total of 80 patients enrolled in our study among them 30 patients developed SSIs. In our study-based on age distribution of the study population, 33.3% of the patients are 41-50 years old, another 33.3% of the patients are 51-60 years, 26.7% of the patients are 61-70 years and 6.7% of the patients are more than 70 years. Majority of the patients in our study age is between 40 to 60 years. The mean age of our study is 56.13±8.90 (Table-1). Based on gender distribution, 21 of the total population are male and remaining nine patients are female (Figure-1). But there is statistically insignificant relationship between gender and development of surgical site infection

The neck, chin, and suture line of extraoral wounds were the most often seen sites of infection. Based on culture positive pus samples 46.7% of the patients were infected with Pseudomonas aeruginosa 16.7% of the patients infected with Beta haemolytic streptococci, 10% of the patients infected with Staphylococcus aureus, 10% of the patients infected with Staphylococcus species, 6.7% of the patients infected with Enterococcus faecalis, 3.3% of the patients infected with Escherichia coli, another 3.3% of the patients infected with Neisseria species, , 3.3% of the patients infected with other Pseudomonas species (Table-2).

The predominant causative organisms isolated were Pseudomonas aeruginosa and streptococcus species, accounting for 50% and 16.7% of the infections, respectively. Other organisms included Staphylococcus aureus and Escherichia coli, enterococcus faecalis each constituting less than 10% of the cases. Antibiotic sensitivity testing revealed that Piperacillin+tazobactum was the most effective antibiotic, showing sensitivity in 90% of the Pseudomonas isolates and 85% of the Streptococcus isolates. Other antibiotics tested included Ciprofloxacin, Amoxicillin-Clavulanic acid, and Vancomycin, Amikacin, gentamicin with Piperacillin- tazobactam demonstrating superior efficacy (Table- 3).

Table 1: Age

Age in years	No of patients (n=30)	(%)
41-50	10	33.3
51-60	10	33.3
61-70	8	26.7
>70	2	6.7

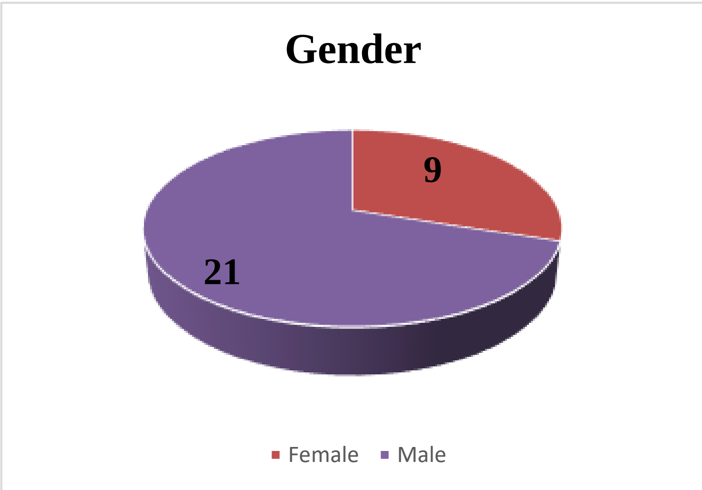

Figure 1: Gender

Table 2: Culture report

Culture report	No of patients (n=30)	(%)
Beta haemolytic streptococci	5	16.7
Enterococcus feacalis	2	6.7
Escherichia coli	1	3.3
Neisseria sp.	1	3.3
Pseudomonas aeruginosa	14	46.7
Pseudomonas sp.	1	3.3
Staphylococcus aureus	3	10
Staphylococcus sp	3	10

Table 3: Antibiotic sensitivity

Antibiotic	No (%)	Yes (%)	Total
Gentamicin	22 (73.3%)	8 (26.7%)	30
Meropenem	21 (70%)	9 (30%)	30
Vancomycin	22 (73.3%)	8 (26.7%)	30
Piperacillin+ Tazobactum	13 (43.3%)	17 (56.7%)	30

5. Discussion:

Surgical site infections (SSIs) are a serious post-operative complication that are associated with oral squamous cell carcinoma patients in particular. Surgical site infections caused by bacterial contamination are a dangerous side effect that can lead to tissue reconstruction problems, fistula formation, wound disintegration, and delayed wound healing. These infections may result in longer hospital stays, higher medical expenses, and less favourable patient outcomes. Effective management and prevention of surgical site infections (SSIs) depend on the identification of the causative organisms and their patterns of antibiotic sensitivity.

In our study most of the patients are between 40-70 years. Male patients constitute the majority in our study. In the French population with head and neck malignancies, men were more likely than women to have wound infections. in his study there is a tendency for head and neck malignancies to affect men more than women. Similar results showed the study conducted by Rao SV et al 2024 [11]. In this investigation, the incidence of SSI was determined to be 33.3%. An SSI incidence of 13.3% was found in a study by Durand et al. to ascertain the time course and microbiology of SSIs following head and neck free flap surgery [12].

Incidence of surgical site is associated with multiple factors including tumor stage, ASA classification, reconstruction with the flap [13].

Relevant Cochrane studies are available within the field of SSI to assess the six principles that form the basis of traditional surgical practice:

- Preoperative skin antiseptics to avoid surgical site infections following clean surgery [14]
- Antimicrobial medications to treat colonisation by MRSA [15]
- Hair removal before to surgery to lower SSI [16]
- Hand antisepsis surgery to lower SSIs [17]
- Using skin antiseptics during a preoperative wash or shower to avoid SSI [18]
- Topical medications and dressings for secondary intention surgical wound healing [19].

Pneumonia, Surgical site infections and gastrointestinal infections made up the majority of infections [20]. The amount and movement of personnel as well as the physical characteristics of the operating room have an impact on the frequency of SSIs [21]. Perineural invasion positive patients had significantly worse overall survival (45% vs. 75%, $p < 0.001$) and disease-free survival (35% vs. 70%, $p < 0.001$). Perineural invasion is independently associated with poorer outcomes and advanced disease associated with surgical site infection [22].

In our study the predominant causative organisms isolated were Pseudomonas aeruginosa and streptococcus species, accounting for 50% and 16.7% of the infections, respectively. Other organisms included Staphylococcus aureus and Escherichia coli, enterococcus faecalis each constituting less than 10% of the cases. Depending on the patient's age, the population being treated, and the location of the cancer, different studies have reported different bacterial flora causing SSI in cancer patients. Of the pathogens isolated, gram-negative E. Coli accounted for 27.5%, followed by gram-positive S. aureus (16.3%) [23]. In a similar vein, an Indian study reported that E. Col was the predominant pathogen causing SSI [24]. Regardless of the source of infection, the gram-positive bacterium S. aureus remains the primary cause of surgical site infections (SSI) in cancer patients in affluent nations like USA [25].

6. Conclusion:

The infection patterns of gram-positive and gram-negative microorganisms that cause SSI have been identified with the aid of this study. Therefore, it is imperative that infection control procedures be followed closely in cancer patients with impaired immune system. It is essential to identify the organism causing surgical site infections (SSIs) and its antibiotic resistance pattern in order to begin effective antimicrobial prophylaxis. Health care professionals have a greater responsibility to prevent SSI by implementing strong infection control procedures rather than treating them.

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