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Head and Neck Cancer

Surgical Site Infection in Head and Neck Cancer Patients: Observations from A Tertiary Care Hospital

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Abstract

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Background Surgical site infections (SSIs) in head and neck cancer (HNC) patients can significantly affect the outcome of the surgery. Appropriate antimicrobial prophylaxis is needed for prevention of SSI.

Aim To study the causative agents causing SSI among the HNC patients and their drug resistance pattern.

Materials and Methods This was a retrospective study. The antibiotic suspectibility pattern of the aerobic bacteria isolated from the wound infection in the patients underwent surgery for head and neck cancer, admitted from January 2015 to December 2016 were added in the study. The demographic details of patients, pathogens isolated, and their antimicrobial susceptibility were collected, entered into Microsoft Excel, and statistical analysis was done as per percentage of isolates and drug resistance.

Results A total of 130 culture-positive pus samples were included in the study. The majority of the samples were from males (71.5%), one-third of the patients belonged to the sixth decade of their life. Buccal mucosa and tongue were the common cancer in the head and neck region. The common gram-negative pathogens were *Klebsiella* sp. and *Acinetobacter* sp. and *Staphylococcus aureus* and *Enterococcus* sp. among the gram-positive bacteria. Methicillin-resistant *S. aureus* isolation rate was noted to be as high as 64.28%. High levels of resistance to aminopenicillins, third generation cephalosporins, co-trimoxazole and fluoroquinolones among the gram-negative pathogens. Anti-MRSA drugs such as vancomycin, linezolid, and teicoplanin resistance was not seen among *S. aureus*.

Conclusion The resistance pattern among the pathogens isolated from SSI in HNC patients is alarming. So, implementation of strict infection control practices to prevent SSI rather than treating them with high end antimicrobials is the best option.

Keywords
- head and neck Cancer
- surgical site infection
- multi-drug resistance
- MRSA

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Introduction

Head and neck cancers are of very much public health importance, accounting for more than 650,000 cases around 330,000 deaths annually.[1] The head and neck cancers are the cancers that are occurring in the oral cavity, pharynx, nasal cavities, and paranasal sinuses, ears, eyes, and orbit, scalp, and salivary glands.[2] The site of occurrence of these cancers interferes with some of the basic functions of life such as swallowing, breathing, and higher functions such as speech, hearing, vision, smelling and taste.[3]

There is gender predisposition toward men in head and neck cancers. The major pre-disposing factors being excess consumption of alcohol and tobacco, were postulated more than two and half decade ago.[4] This causes cancer to be from diverse origin such as epithelium, especially squamous cell carcinoma, others being lymphocytes (lymphoma), soft tissue (sarcoma), and endocrine tumors.[5] Thus requires a multidisciplinary approach with surgery, radiotherapy, chemotherapy, reconstructive surgery, speech therapy, psychological support.[6]

For improved curative rates, wide resection and reconstruction are the most accepted mode of treatment.[7] However, the prognosis is greatly affected when the surgical site gets infected, causing increased treatment cost, prolonged length of stay in hospital, and delayed in other treatments such as chemo- or radiotherapy.[8]

The surgical site infections (SSIs) can be prevented with appropriate pre-surgical antimicrobial prophylaxis, following aseptic precautions during the surgery and postoperative care. Thus, to initiate appropriate antimicrobial prophylaxis, the flora causing SSIs has to be known with its antimicrobial resistance pattern. So, this study was undertaken to study the pathogens causing SSI and their antimicrobial resistance pattern.

Materials and Methods

This is a retrospective study carried out in the department of Microbiology/Infection control of Fr Muller Medical College Hospital, Mangalore, India. The data on the antibiotic sensitive pattern of the aerobic bacteria isolated from the wound infection in the patients undergoing surgery for head and neck cancer, admitted from January 2017 to December 2018, were collected. The demographic details were collected from the medical records departments, and microbiological data were collected from the clinical laboratory, after obtaining permission from the Institutional Ethics Committee.

The culture of the pus sample was done on sheep blood agar and MacConkey agar and pathogens isolated were identified according to the standard microbiological procedure. Antimicrobial susceptibility test was done as per the Clinical Laboratory Standard Institute (CLSI) guidelines.[9] The antimicrobial susceptibility was tested against ampicillin (10 µg), ceftriaxone/ceftazidime/cefoxitin (30 µg), cotrimoxazole (25 µg), gentamicin (10 µg), amikacin (30 µg), ciprofloxacin (5 µg), and levofloxacin (5 µg). Additionally, piperacillin/tazobactam (100/10 µg), meropenem (10 µg) for gram-negative pathogens and erythromycin (15 µg), clindamycin (2 µg), vancomycin (30 µg), linezolid (30 µg), teicoplanin (30 µg) for gram-positive pathogens were tested. The collected data were entered into Microsoft Excel, and statistical analysis was done as per percentage of isolates and drug resistance.

Results

A total of 130 culture-positive pus samples were detected during the study period. The majority of the samples were from males (71.5%) and one-third of the patients belonged to the sixth decade of their life (►Table 1). Most patients included in the study had cancer of buccal mucosa (46, 35.38%), followed by tongue (27, 20.77%). From the 130 exudate samples, 235 pathogens were isolated. The gram-negative pathogens accounted for 158 (67.23%) and gram-positive pathogens (77, 32.77%). *Klebsiella* sp. outnumbered among the gram-negative pathogens followed by *Acinetobacter* sp. (►Table 2). Among the gram-positive, *Staphylococcus aureus* was the commonest followed by *Enterococcus* sp.(►Table 2). Methicillin-resistance isolation was noted to be as high as 64.28% and 63.9% among coagulase-negative *Staphylococcus* (9/14) and *S. aureus*

Table 1 Demographic details of head and neck cancer patients

	Parameters	No. of patients ($n = 130$)	%
Age	<30	3	2.31
	31–40	19	14.62
	41–50	24	18.46
	51–60	43	33.08
	61–70	31	23.85
	71–80	6	4.62
	81–90	4	3.08
Gender	Male	93	71.54
	Female	37	28.46
Site of tumor	Buccal mucosa	46	35.38
	Tongue	27	20.77
	Oral cavity	14	10.77
	Alveolus	12	9.23
	Larynx	11	8.46
	RMT	5	3.85
	Maxilla	3	2.31
	Thyroid	3	2.31
	Floor of mouth	3	2.31
	Glottis	2	1.54
	Pharynx	2	1.54
	PFS	1	0.77
	Metastasis of unknown origin	1	0.77

Table 2 Distribution of pathogens isolated from SSI of head and neck cancer patients

Gram-negative	**158**	**67.23**
Klebsiella sp	56	23.83
Acinetobacter sp	36	15.32
Escherichia coli	30	12.77
Pseudomonas aeruginosa	19	8.09
Citrobacter sp.	9	3.83
Proteus sp.	8	3.40
Gram-positive	**77**	**32.77**
Staphylococcus aureus	36	15.32
Enterococcus sp.	16	6.81
Coagulase-negative *Staphylococcus* (CoNS)	14	5.96
Corynebacterium sp.	11	4.68
	235	100.00

(23/36), respectively. The study of antimicrobial susceptibility revealed a high level of resistance to aminopenicillins, third-generation cephalosporins, co-trimoxazole, and fluoroquinolones among the gram-negative pathogens. The high-end antimicrobials such as β lactam-β lactamase inhibitor combination, carbapenems, and aminoglycosides were sensitive to around 45% of the *Klebsiella* isolates. However, in case of *Acinetobacter* sp., resistance to high-end antimicrobials is more than 80% (►Table 3). Among *E. coli* and other gram-negative pathogens more than 55% were susceptible to high-end antimicrobials. Only *Acinetobacter* sp. isolates were the difficult to be treated among the gram-negative pathogens. Among the gram-positive pathogens, MRCoNS and MRSA isolation rate was high. The penicillin, 3GC, fluoroquinolones resistance was very high. Anti-MRSA drugs such as vancomycin, linezolid, and teicoplanin resistance was not seen among *S. aureus* and *Enterococcus* sp. isolated, but resistance to linezolid was emerging among the CoNS (►Table 4).

Discussion

Surgical site infection is one of the important nosocomial infections, which is caused by highly antimicrobial-resistant bacteria. In turn, it causes prolonged hospital stay, increased antimicrobial therapy, medical costs, comorbidity, emotional trauma, further reducing the immune status of the cancer patients, leading to further delay in other adjuvant therapies.[10] In Mexico, around 8% of SSI was reported among 23,421 surgeries performed in a 7 years retrospective study. In another study on 110 oral cancer patterns, SSI rate was noted as 22.7%.[11] Similarly, in 260 French patients with head and neck squamous cell carcinomas undergoing surgical procedure, 117 (45%) were infected.[8] The males were more prone to wound infection compared to females in head and neck cancers in the French population,[8] similar trend is found in our study.

Various studies have reported different bacterial flora causing SSI in cancer patients, depending on the age of patient, population treated, and site of cancer. Among the pathogens isolated, gram-negative *E. coli* accounted for (27.5%), followed by gram-positive, *S. aureus* (16.3%).[12] Similarly, an Indian study reported *E. coli* being the predominant pathogen causing SSI.[13] However, in our study, even though gram-negative bacilli outnumbered, *Klebsiella* sp. was as the predominant pathogen. This emphasis the flora causing SSI can vary among the hospitals. In developed countries such as the USA, gram-positive pathogen, *S. aureus* continues to be the leading causing of SSI in cancer patients irrespective of site of infection.[14]

The study of resistance pattern among gram-negative pathogens revealed a high level of resistance to commonly used antimicrobials such as aminoglycosides, fluoroquinolones were ineffective in the study, similar to our isolates.[12] In an Indian study, high level of resistance, i.e., around 63% to third-generation cephalosporins such as cefotaxime and ceftazidime were observed among the gram-negative pathogens in SSI in cancer patients.[13] The predominant gram-negative pathogens such as *Klebsiella*, *Acinetobacter*, and *E. coli* had resistance to a range of 90 to 98% to 3GC in our patients. The resistance to β lactam-β lactamase

Table 3 Antimicrobial resistance pattern among gram-negative pathogens isolated from SSI

	***Klebsiella* sp. (56)**	***Acinetobacter* sp. (36)**	***Escherichia coli* (30)**	***Pseudomonas aeruginosa* (19)**	***Citrobacter* sp. (9)**	***Proteus* sp. (8)**
Ampicillin	–	100.00	93.33	–	100.00	100.00
3GC	98.21	97.22	90.00	21.05	77.78	62.50
Cotrimoxazole	69.64	75.00	80.00	–	88.89	62.50
Gentamicin	42.86	91.67	43.33	15.79	22.22	75.00
Amikacin	41.07	80.56	6.67	15.79	11.11	37.50
Ciprofloxacin	75.00	94.44	86.67	15.79	88.89	50.00
Levofloxacin	53.57	72.22	83.33	10.53	55.56	37.50
Piptaz	75.00	91.67	40.00	15.79	33.33	0.00
Meropenem	53.57	83.33	23.33	5.26	0.00	25.00

Table 4 Antimicrobial resistance pattern among the Gram positive pathogens isolated from SSI

	Staphylococcus aureus (36)	*Enterococcus* sp. (16)	Coagulase-negative *Staphylococcus* (14)
Ampicillin	94.44	43.75	100.00
3GC	63.89	–	71.43
Cotrimoxazole	41.67	–	35.71
Gentamicin	50.00	68.75	50.00
Amikacin	27.78	0.00	14.29
Ciprofloxacin	91.67	68.75	50.00
Levofloxacin	69.44	62.50	35.71
Erythromycin	52.78	0.00	71.43
Clindamycin	41.67	0.00	57.14
Vancomycin	0.00	0.00	0.00
Teicoplanin	0.00	0.00	0.00
Linezolid	0.00	0.00	7.14

inhibitor and carbapenems was reported to as high as 85% in pathogens causing SSI an Egyptian patients[15]; similarly, we reported a resistance range from 75 to 92% in various isolates. Among the gram-positive isolates, *Staphylococcus* sp. and *Enterococcus* sp. are the common pathogens causing SSI in cancer patients.[13,15] The methicillin resistance have be reported as high as 40%. We had MRSA isolation rate (64.28%) among *S. aureus* higher than other studies[12,13,16,17] but higher rates are been reported in Egyptian patients.[15]

Conclusion

In the present study, we have studied the pathogens causing SSI in head and neck cancer patients. This study has helped to identify resistance patterns in both gram-negative and gram-positive pathogens causing SSI and highlights that the antimicrobial resistance among these pathogens is occurring at a very alarming rate. So, the infection control practices need to be implemented strictly in these immunocompromised cancer patients. The SSI in the cancer patients studied denotes that the pathogens are predominantly gram-negative *Klebsiella* sp. and *Acinetobacter* sp., which are multi-drug resistant. Among gram-positive, MRSA and *Enterococcus* sp. are of concern, the treatment option available is very less. So, greater responsibilities lies on the health care workers on implementation of strict infection control practices to prevent SSI rather than treating them.

Conflict of Interest
None declared.

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