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Evaluation of Postoperative Electrolyte Imbalance of Oral Squamous Cell Carcinoma Patients: A Study in a Tertiary Level Hospital

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Abstract

This cross-sectional observational study was performed to evaluate the post-operative electrolyte imbalance in oral squamous cell Carcinoma patients, and it was conducted at the Department of Oral & Maxillofacial Surgery in Dhaka Dental College & Hospital, Dhaka, Bangladesh during June 2022 to June 2023. A total of 100 patients who were clinically and histo-pathologically diagnosed as OSCC patients were enrolled in this study. The collected data were edited, coded processed for computer data entry. The data were analyzed using Statistical Package for Social Sciences (SPSS) software, version-23.0. Descriptive analysis was performed and the results were presented as tables and graphs. Unpaired t tests, Chi-square, Spearman's rho correlation tests were performed to compare the mean and ratio correlation of the study variables where P<0.05 with 95%CI. The ethical clearance of this study was obtained from the Ethics Committee of Department of Oral & Maxillofacial Surgery in Dhaka Dental College & Hospital, Dhaka, Bangladesh. A total of 100 oral squamous cell carcinoma (OSCS) patients were enrolled in this study. The mean age of the patients was 56.63 ± 9.54 years. The mean BMI of the patients was 18.20 ± 0.60 kg/m^2. The majority of the patients were male and it was 54% while female was 46%. 64% patients belonged to lower socio-economic class. 52% patients had the habit of betel nut which was the highest while 39 % had the habit of betel nut with tobacco. The majority, 32% of patients had Stage-I. The mean surgery duration was 5.45± 0:91 hours and 7.2±: 0:15 minutes. The mean blood required for the surgery 1.44±0.68 units. According to the distribution of the post-operative variations of electrolyte imbalances, Sodium (Na+) was observed, hypo 25(25%) and hyper0(0%) on day-1 and hypo 31(31%), and hyper 4(4%) was observed on day 3 and followed by Potassium (K+) hypo 5(5%) and hyper 2(2%) on day- 1 and hypo 7(7%) and, hyper2(25) on day- 3. In comparison of ratio between hypo and hyper of day1 and day-3, showed statistically significant relationship observed (p<0.05). According to postoperative electrolyte distribution, on day-1, mean Sodium (Na+) was observed 136.68±2.69 mmol/L whereas on day-3, mean Sodium (Na+) was observed 133.81±4.21 mmol/Land followed by on day-1 mean Potassium (K+),3.86±0.46mmol/L, day-3, mean Potassium (K+),3.74 ±0.45 mmol/L on day-1. Among the postoperative electrolyte, except, Potassium (K+), all were observed statistically significant (P<0.05). In conclusion, hypocalcaemia, hyponatremia, and hypomagnesaemia are the relatively common after maxillofacial surgeries. Beside this BMI could affect electrolyte abnormalities after maxillofacial surgery.

Keywords: Demographic, Clinical, Characteristics, Oral, Cell, Carcinoma

Introduction

Electrolytes including potassium, sodium, magnesium, calcium, and phosphate play important roles in enzymatic and biochemical reactions, the regulation of cellular membrane potentials, energy transformation, neurotransmission, nerve signal conduction, hormone function, muscle contraction, cardiovascular role, bone composition, and fluid and acid base regulation [1]. Acute and severe electrolyte imbalances can induce a wide variety of clinical disorders, such as severe arrhythmias and neuromuscular dysfunction and are associated with increased morbidity

and mortality [2]. The risk posed by these abnormalities increases significantly when more than one electrolyte is deficient, and the severity of the symptoms is commonly associated with the severity of the disorder and the rate at which the disorder progresses [3]. Changes in both fluid volume and electrolyte composition happen preoperatively, intraoperatively, and postoperatively [4]. Postoperative surgery patients are prone to electrolyte changes probably because of the loss of blood and bodily fluids, the stress response to surgery, fasting before surgery, the inability of the patients to receive necessary nutrition etc [5, 6]. Sodium plays a key role in maintaining fluid balance of the body and also influences the functioning of the bodily muscles and the central nervous system. This electrolyte is the most abundant in the blood plasma and plays a major role in maintaining water balance in the blood and tissues. Sodium disorders are associated with an increased risk of morbidity and mortality [7]. Hyponatremia is one of the common electrolyte abnormalities defined as a serum sodium level of less than 135 mEq/L and hyponatremia is the most common postoperative electrolyte disorder caused by surgical stress [8]. Potassium disorders are common. Hypokalemia (serum potassium level less than 3.6 mEq/L) is reported up to 21% among hospitalized patients and 2 to 3% among outpatients. The most common disorder after hyponatremia is a hypokalemia, which causes problems such as arrhythmia and muscle weakness [9]. Hyperkalemia (serum potassium level more than 5 mEq/L) occurs in up to 10% of hospitalized patients and approximately 1% of outpatients. Hyperkalemia occurs commonly in hospitalized patients and is of particular concern for those who have undergone surgery, with postoperative care provided by clinicians of many disciplines [10]. Magnesium is one of the most common co-factors and is crucial to more than 300 enzyme-driven biochemical reactions in the body. Normal magnesium levels are between 1.8–2.5 mg/dL, with levels less than 1.8 mg/dL defining hypomagnesemia [11, 12]. Hypomagnesemia is commonly found in current medical practice mainly in critically ill and postoperative patients. Clinical symptoms of hypomagnesemia include neuromuscular, neurologic, psychiatric, and cardiac disorders, which may significantly increase the morbidity of such patients [13]. Postoperative hypocalcemia has been reported in a population of healthy patients undergoing surgery. The patients who receive massive blood transfusion during an acute surgical crisis are at risk of developing hypocalcemia [14]. Considering the importance of electrolytes and the role of surgery in causing electrolyte imbalance in the body, the aim of this paper was to evaluate electrolyte disturbances (potassium, sodium, magnesium, and calcium) among the patients undergoing oral squamous cell carcinoma surgery.

Materials and methods

This descriptive type of cross-sectional study was conducted in at the department of Department of Oral & Maxillofacial Surgery, Dhaka Dental College Hospital, Dhaka, Bangladesh during June 2022 to June 2023. Written informed consent was taken and a total of 100 patients aged 18 and above, who were clinically and histopathologically diagnosed as OSCC would report to the Department of Oral & Maxillofacial Surgery of Dhaka Dental College Hospital, Dhaka, Bangladesh were enrolled in this study. Purposive consecutive sampling technique was used in this study. The demographic data were collected by face to face interview and clinical data were collected by previous case history with a restructured questionnaire and a case record form. To determine the postoperative electrolyte, the blood samples of day-1 and day-3 of the enrolled postoperative patients were collected and sent to the central lab of the hospital and a standard protocol was used to determine the level of electrolyte of the patients. The collected data were organized and entered into computer. Then the data were analyzed by using Statistical Package for Social Sciences (SPSS) software, version-23.0. Descriptive statistical analysis were performed and the results were presented in table and charts. Chi-square test and unpaired t tests were performed to compare the electrolyte imbalance and variations of electrolyte, where $P<0.05$ considered as the level of significance. In the variosions of electrolyte, Na+ level<136(mmol/L-Hypo, K+ level <3.5(mmol/L) considered as hypo, Ca level <8.5(mg/L) considered as hypo, Ca level >10.5(mg/L) considered as hyper, Na+,level>45(mmol/L considered as hyper, K+ >5.1(mmol/L) considered as hyper, Mg level<1.6(mg/dL considered as hypo, Mg level<2.6(mg/dL) considered as hypo.The ethical clearance of this study was obtained from the Ethics Committee of Dhaka Dental College and Hospital, Dhaka, Bangladesh. The Inclusion criteria include patient undergoing oral squamous cell carcinoma surgery and they were hospitalized for > 3 days.

Results

Table 1: Baseline characteristics of the study patients (N=100).

Age Groups (Years)	Frequency (N=100)	Percent
18-30	1	1
31-40	6	6
41-50	16	16
51-60	39	39
61-70	32	32
71-80	6	6
Mean age (Years)	**56.63±9.54**	
Total	100	100
Sex		
Male	54	54
Female	46	46
Total	100	100
Socio-economic condition:		
Upper class	36	36
Lower class	64	64
Total	100	100
Mean BMI:	**18.20±0.60 kg/m^2**	
Mean Blood Required(bags):	1.44±0.68	

Table 1: Shows the baseline characteristics of the study patients. According to the age distribution, 39% patients belonged to the age group (61-70) years and followed by 32% patients age group (41-50) years, 16% patients, age group (31-40) years, 6% patients, age group (71-80) years, 6% patients, age group (18-30) only 1% patients, age group(!8-30) years. The mean age of the patients was 56.63±9.54 years.. According to the sex distribution, 54% patients were male and the female patients were 46%. The most frequent socio-economic condition of the patients was observed upper lower class 64(64%). The mean BMI of the patients was 18.20±0.60 kg/m^2. The mean blood required for the surgery of the patients 1.44±0.68 bags

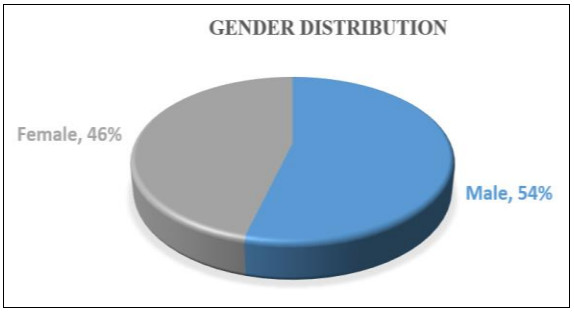

Fig 1: Shows the gender distribution of the study patients (n=100)

Table 2: Patients habit associated with the oral squamous cell (N=100)

Habit of the patients	Frequency	Percent
No habit	1	1
Betel nut	52	52
Tobacco	8	8
Betel nut with tobacco	39	39
Total	100	100

Table 2: shows the distribution of the habit associated with the oral squamous of the study patients. According to the habit associated with the oral squamous distribution, 52% of patients had the habit of betel nut and followed by 39% of patients had betel nut with tobacco,8% of patients had tobacco, 1% of patients had no habit.

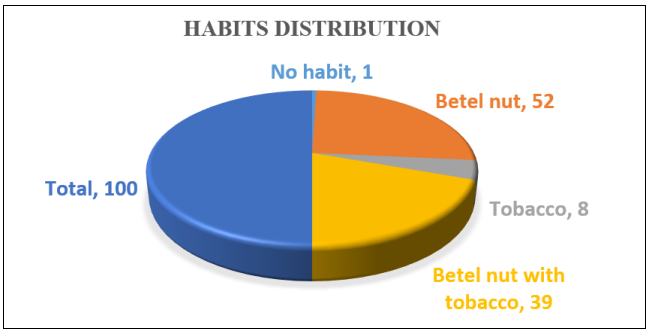

Fig 2: Shows patients habit associated with the oral squamous cell carcinoma (n=100)

Table 3: Pre surgical histological grading of the oral squamous cell carcinoma (N=100)

Pre surgical histological grading	Frequency	Percent
Grade-I	39	39
Grade-II	54	54
Grade-III	7	7
Total	100	100

Table 3: shows the distribution of pre surgical histological grading of the oral squamous observed of the study patients. According to the distribution of pre surgical histological grading, 54% of patients had Grade-II and followed by 39% of patients had Grade-I and 7% of patients had Grade-III.

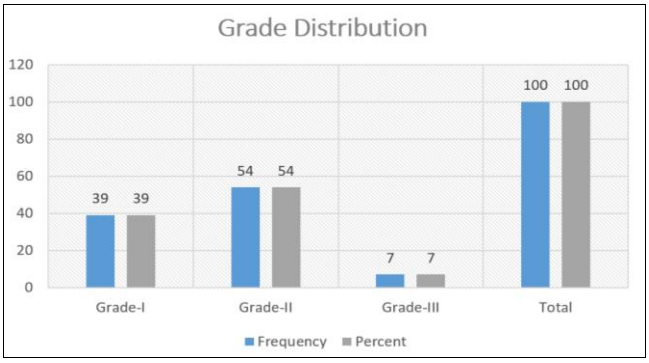

Fig 3: Shows the pre surgical histological grading of the oral squamous cell carcinoma (n=100)

Table 4: Postoperative Electrolyte Imbalance among the study patients (n=100)

Electrolyte Imbalance	Day-1	Day-3	P-value
	Mean ±SD	Mean± SD	
Sodium(Na+)	136.68±2.69	133.81±4.21	<0.001
Potassium(K+)	3.86±0.46	3.74 ±0.45	0.06
Calcium(Ca)	8.56±0.61	8.24±0.75	<0.001
Magnesium(Mg)	2.10±0.38	1.80±0.54	<0.001

*Unpaired t tests were performed to compare the group mean at the level of significance 0.05 with 95%CI

Table 4: shows the postoperative electrolyte imbalance among the study patients. According to postoperative electrolyte distribution, on day-1, mean Sodium(Na+) was observed 136.68±2.69 mmol/L whereas on day-3, mean Sodium (Na+) was observed 133.81±4.21mmol/L and followed by on day-1 mean Potassium (K+),3.86±0.46mmol/L,day-3, mean Potassium(K+),3.74 ±0.45 mmol/L on day-1, mean Calcium (Ca), 8.56 ± 0.61 mg/dl, day-3, mean Calcium(Ca), 8.24±0.75mg/dl, on day-1, mean Magnesium (Mg), 2.10 ±0.38,mg/dl ,on day-3, mean Magnesium(Mg, 1.80±0.54 mg/dl. Among the postoperative electrolyte, except, Potassium (K+), all were observed statistically significant (P<0.05).

Table 5: Postoperative variations of Electrolyte imbalances (N=100)

Electrolyte	Day-1		Day-3		P-value
	Variations	N (%)	Variations	N (%)	
Sodium(Na+)	Hypo	25(25%)	Hypo	31(31%)	0.345
	Hyper	0(0%)	Hyper	4(4%)	0.043
Potassium(K+)	Hypo	5(5%)	Hypo	7(7%)	0.562
	Hyper	2(2%)	Hyper	2(2%)	1
Calcium(Ca)	Hypo	20(20%)	Hypo	25(25%)	0.398
	Hyper	3(3%)	Hyper	5(5%)	0.771
Magnesium(Mg)	Hypo	18(18%)	Hypo	21(21%)	0.593
	Hyper	7(%)	Hyper	6(6%)	0.774

* Na+ level<136(mmol/L-Hypo, K+ level <3.5(mmol/L) - Hypo, Ca level <8.5(mg/L)-Hypo, Ca level >10.5(mg/L)-Hyper *Na+ level>145(mmol/L-Hyper, K+ >5.1(mmol/L)-Hyper, Mg level<1.6(mg/dL-Hypo, Mg level<2.6(mg/dL)-Hypo

Table 5: shows the distribution of post-operative variations of electrolyte imbalances of the study patients. According to the distribution of the post-operative variations of electrolyte imbalances, Sodium (Na+) was observed, Hypo, 25(25%) and Hyper 0(0%) on day-1 and Hypo,31(31%),and Hyper,4(4%) was observed on da3 and followed by Potassium (K+) Hypo 5(5%) and Hyper 2(2%) on day-1 and Hypo 7(7%) and Hyper2(25) on day- 3,Calcium (Ca), Hypo 20(20%) and Hyper 3(3%)on day-1and Hypo 25(25%) and Hyper5(5%) on day3, Magnesium(Mg) Hypo18(18%) and Hyper7(7%) on day- 1 and Hypo 21(21%) and Hyper 6(6%) on day-3. In comparison of ratio between hypo and hyper of day1 and day-3, no statistically significant relationship observed (p>0.05).

Discussion

This study was performed on 100 patients at the Department of Oral & maxillofacial surgery in Dhaka Dental College Hospital, Dhaka, Bangladesh who had received oral cancer surgery. The inorganic electrolytes are important components of body fluid as they play a crucial role. Abnormalities of fluid and electrolyte are very common in patients undergoing surgical procedures. These abnormalities can range from mild, readily correctable deviations to life-threatening ones that demand immediate attention [15]. The frequency of electrolyte imbalances of sodium, potassium, calcium, and magnesium of preoperative day one and three and postoperative day one and three were evaluated in this current study. In this study 39% patients belonged to the age group (61-70) years and the mean age of the patients was 56.63±9.54 years, mean BMI of the study patients was 18.20±0.60 kg//m2. According to the sex distribution, 54% patients were male and the female patients were 46%. showing similarity with the study of Soltaninia O *et al*. the age of the patients ranged from 19 to 54 years (mean age=42.31 ± 1.9); 68 patients (67.3%) were male and 33 (32.7%) were female where also few demographic information (e.g., age and gender), weight, height, body mass index (BMI), kinds of trauma, medication, comorbidity and clinical data were compiled for each patient like this report [16]. Stating the habit association with the oral squamous distribution, 52% of patients had the habit of betel nut and followed by 39% of patients had betel nut with tobacco, 8% of patients had tobacco,1% of patients had no habit differing with the study of Aquino *et al*. reported 75% of patients were alcohol users along tobacco users about 90% among them [17].This current study observed among postoperative electrolyte imbalances, hyponatremia had the highest frequency (25%), and hypermagnessima was 7% on day-1 while on day-3, the highest frequency was observed hyponatreimia (31%) and hypermagnessima 6% which was the highest resembling greater similarity with the study of Soltaninia *et al*. [16] where results show that, among electrolyte imbalances, hypocalcemia had the highest frequency (26.3%), followed by hyponatremia (18.7%), and hypermagnesemia (16.6%), while potassium showed the least changes (6.3%) after maxillofacial surgery. This result was contrary to the results obtained by El Sherif and Turitto [18] in which hypokalemia was the most common electrolyte abnormality encountered in hospitalized patients. In study of Kamoun *et al*. results showed that hyponatremia was the most common electrolyte imbalance with 16.7%, followed by hypokalemia with 14.2%. These results are somewhat consistent with our findings regarding postoperative sodium abnormality, but the frequency of hypokalemia was greater compared to our study [19]. This difference could be due to the type of surgery and age of the patients participated in this study. In our study it was observed the mean postoperative electrolyte of day one is more than the day three (p=0.001), except Potassium (K+) (p=0.060). That means, except Potassium, the other components of electrolyte got changed on day three. In a study electrolyte disorders following cardiac surgery were investigated. The results of this study revealed that, after an open-heart surgery, 88% of patients showed at least one type of electrolyte disorder. The stay in hospital for prolong duration also related to the procedure completed for the patient. The longer the duration the possibilities of post-operative electrolyte picture showed obvious relation stated by Kushnir *et al* relevant to this study results like According to the distribution of the surgery duration, 48% of the study patients took 6 hours and followed by 36% of patients 5 hours with the mean surgery duration was 5.45± 0:91 hours [20]. Current study correlates preoperative electrolyte imbalance by BMI of the study patients. Day-1 and day-3 was observed statistically significant (p<0.05), except Magnesium (Mg) on day-3(p=0.041). The correlation of postoperative electrolyte imbalance with BMI by day. Postoperative electrolyte correlation with BMI by day was observed on day-1 Sodium (Na+), and Calcium (Ca) statistically correlated with BMI (p<0.05) whereas on day-3, no statistical correlation was observed between electrolyte and BMI of the study patients showing common scenario with the study of a previous study [16].

Conclusion

This study observed, postoperative electrolyte imbalances among the patients of oral squamous carcinoma. Therefore, hypocalcaemia, hypernatremia, and hypomagnesaemia are relatively common in the postoperative patients of oral squamous. This study also observed among the postoperative electrolytes only sodium (Na+) is correlated with BMI by day-1. So, these findings and data may be a great use to prevention, diagnosis, and early treatment of the patients of oral squamous carcinoma.

Conflict of Interest: Author declare no conflict of interest.

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