Indian Journal of Surgical Oncology (September 2020) 11(3):475–481
https://doi.org/10.1007/s13193-020-01135-1

ORIGINAL ARTICLE

Factors Predisposing to the Unplanned Hospital Readmission (UHR) in Patients Undergoing Surgery for Oral Cavity Squamous Cell Carcinoma (OSCC): Experience from a Tertiary Cancer Centre

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Received: 14 April 2020 / Accepted: 8 June 2020 / Published online: 15 June 2020

Abstract

Unplanned hospital readmissions (UHR) are known to add to patient morbidity, increase the cost of the treatment, and negatively impact the postoperative quality of life. The objective of the study was to identify the UHR rates of oral cavity squamous cell carcinoma (OSCC) patients following surgery and identify the predisposing factors for UHR. We conducted this retrospective analysis of all patients who underwent surgery for OSCC in our (single) surgical unit from January 2016 to December 2018. A total of 804 patients satisfied the eligibility criteria. Majority of the patients were males ($n = 650$, 80.8%). The median age of the patients was 50 years (Range: 16–89 years). The most common oral cavity subsite was buccal mucosa gingivobuccal (BM-GBS) OSCC. Forty patients (5%) required an UHR after discharge. The most common reason for readmissions was flap-related issues (11/40) and orocutaneous fistula (10/40). Other causes included wound infection (7/40), chest infection (2/40), hematoma/bleeding (3/40), and other lesser prevalent causes (7/40). Factors that significantly predisposed patients for UHR were re-exploration following the initial surgery [$p < 0.001$, OR 7.9 (4.09–15.59)] and BM-GBS subsite [< 0.001, OR: 2.89(1.24–6.73)]. The UHR rate in our study was 5%. Patients requiring re-exploration following the initial surgery and those with BM-GBS cancer were most likely to have the UHR.

Keywords Oral cancer · Unplanned hospital readmission · Predisposing factors · Re-exploration · Oral cavity subsite

Introduction

Oral cavity squamous cell carcinoma (OSCC) is a common type of cancer worldwide and the second most common cancer in India [1]. Surgery remains the primary treatment modality for OSCC, with or without adjuvant treatment. Surgery for cancer in general is associated with significant physical and mental stress to the patients enduring it [2]. Unplanned hospital readmissions (UHR) following surgery for cancer would only increase this stress, negatively impact the patient's quality of life, delay the initiation of adjuvant therapy, and increase the chances of subsequent mortality [2]. UHR is defined as a subsequent unplanned admission within 30 days or 90 days after the initial treatment (i.e., surgery) [3, 4]. The rates of UHR following surgery for head and neck cancer reported in literature vary between 5.1–26.5% [5]. The costs associated with UHR are very high and it significantly increases the duration of hospital stay and subsequently the cost of treatment adding to the financial burden on the healthcare system [6, 7]. In our country where the state-run hospitals are already overburdened, unplanned readmissions unnecessarily add to the already strained system [8]. Hence healthcare systems have incorporated UHR as a valid tool for measuring healthcare quality and an important indicator of healthcare system performance. In the USA, under the Patient Protection and Affordable Care Act [9] there has been an increase in the scrutiny of hospitals readmission rates. There has been an increasing body of evidence in recent years looking at unplanned readmissions following surgery for head and neck cancers. Graboyes at al reported that patients who experienced a complication in the perioperative period were 11.9 times more likely to be readmitted than those without

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[10]. Most of the evidence available on unplanned readmissions following head and neck cancer treatment include all subsites. To the best of our knowledge, evidence analyzing unplanned readmissions specifically following surgery for OSCC is sparse, and there are no published reports from the Indian subcontinent despite the extremely high prevalence of oral cancer [1].

The aim of our study was to evaluate the incidence of UHR in our cohort of patients undergoing surgery for OSCC and identify risk factors associated with it. Identifying these risk factors may help us take necessary precautions in order to reduce the rates of UHR.

Methods

This is a retrospective study of a prospectively maintained database of all patients who got operated from January 1, 2016, to December 31, 2018, for OSCC in a single surgical unit of a tertiary cancer hospital. All clinical and demographic details were retrieved from the hospital's electronic medical records (EMR) system in addition to our existing database. The various clinical and demographic details collected included age, gender, comorbidities, and previous treatment details. Also details related to admission and discharge for surgery, UHR, type of surgery performed, complications, and their management were also collected. UHR was defined as readmission to our hospital within 90 days following discharge for complications likely related to the primary surgical procedure [4]. We chose the 90-day UHR as it is considered a duration of delivery of comprehensive cancer care following surgery for cancer as per the Centers for Medicaid and Medicare Services (CMS) [4]. Planned admissions for causes like flap divisions and staged neck dissections etc. were not included. We recorded the length of hospital stay during the first admission, date of readmission and the time between the discharge following primary surgery, and the readmission and the primary cause of readmission. Data related to the time to start of appropriate adjuvant therapy was also recorded and analyzed to see the potential effect of unplanned readmissions on delay in adjuvant treatment, if any.

Statistical Analysis

Statistical analysis was done using SPSS version 24 (IBM Corp, Armonk, New York). Univariate analysis was done to test the association for variables based on clinical relevance on the UHR using the chi-square test. Multivariate analysis was done using binomial logistic regression (forward stepwise selection). A p value of < 0.05 was considered significant.

Results

Clinical and Demographic Details (Table 1)

A total of 804 patients satisfied the eligibility criteria and were included in the study. The mean age of the cohort was 50 years (range 16–89 years). Majority of the patients were males (80.8%). The oral cavity subsites were divided broadly into "tongue-floor of mouth (FOM)" and "buccal mucosa-gingivobuccal sulcus (BM-GBS)." Majority of the patients presented with BM- GBS primary ($n = 478$, 59.5%), the rest were Tongue-FOM primary ($n = 326$, 40.5%). Most of these patients presented with advanced disease (Stage III-IV) ($n = 514$, 63.9%). Majority of patients presenting with advanced disease were node positive neck ($n = 321$, 62.5%). The 27.5% ($n = 221$) of patients had received some form of treatment previously, either for the presenting cancer or for a previous cancer. Among patients who received prior treatment, 69 patients (8.6%) received treatment for the presenting cancer in the form of neoadjuvant chemotherapy (NACT) = 64, metronomic chemotherapy = 4, and excision biopsy = 1 for the present primary; the remaining 152 patients (18.9%) received treatments for (Oral) cancer in the past (surgery with or without adjuvant = 145, concurrent chemoradiotherapy/radiotherapy alone = 7). Comorbid conditions were present in 27% ($n = 217$) patients. Diabetes mellitus and hypertension were the two most common comorbidities present. Most patients had more than one comorbidities.

Treatment (Tables 2 and 3)

Approximately one-third of the patients (35.4%) underwent a wide excision alone. Surgery involving mandibular resection, either marginal or segmental, was done in 47.8% of the patients. All patients, except 6.8% of the patients, underwent neck dissection (either an ipsilateral or bilateral or a completion neck dissection) as per the requirement for the primary tumor. Most patients ($n = 792$) required reconstruction of the defect following resection of the primary, except in 12 patients who were provided obturators for their upper alveolectomy defects. Primary closures were done in 212 (26.4%), mostly for defects following wide excision of a tongue primary ($n = 190$). Free flaps were used in 350 (43.5%) patients, pedicled flaps in 175 (21.7%) and local flaps in 55 (6.8%). Re-exploration in the immediate postoperative period had to be done in 89 patients (11%). The most common reason for re-exploration (Table 3) was flap related issues followed by hematoma/bleeding in the immediate post-operative period. The re-exploration for flap related issues was most often seen when the reconstruction was done with a free flap (75/350, 21.4%) ($p < 0.001$).

Table 1 Clinical and demographic details

Factors	Unplanned hospital readmission (numbers (%) ($n = 40$)	No unplanned hospital readmissions numbers (%) ($n = 764$)	Univariate p value	Multivariate p value (OR, 95% CI)
Age				
≤ 60 Years	32 (80%)	601 (78.7%)	0.841	–
> 60 Years	8 (20%)	163 (21.3%)		
Gender				
Male	33 (82.5%)	617 (80.8%)	0.785	–
Female	7 (17.5%)	147 (19.2%)		
Comorbidities				
Yes	13 (32.5%)	204 (26.7%)	0.421	-
No	27 (67.5%)	560 (73.3%)		
Subsite				
Tongue-FOM*	7 (17.5%)	319 (41.8%)	0.002	< 0.001
BM-GBS#	33 (82.5%)	445 (58.2%)		2.89 (1.24–6.73)
Previous Treatment				
Yes	15 (37.5%)	206 (27%)	0.146	-
No	25 (62.5%)	558 (73%)		
cT-Stage				
Early (T1/T2)	12 (30%)	367 (48%)	0.008	-
Late (T3/T4)	28 (70%)	397 (52%)		
cN-Stage				
N0	25 (62.5%)	458 (59.9%)	0.748	-
N+	15 (37.5%)	306 (40.1%)		
Clinical Stage				
Early (Stage I/II)	9 (22.5%)	281 (36.8%)	0.067	-
Late (Stage III/IV)	31 (77.5%)	483 (63.2%)		

*Tongue-Floor of mouth

Buccal mucosa-gingivobuccal sulcus

Unplanned Hospital Readmissions (UHR)

In our cohort of 804 patients, 183 patients (22.7%) had some complications following surgery. Out of these 183 patients with complications, 40 patients (5%) required UHR due to some complications (Table 3) directly related to the primary surgery. The median time to (90 days) UHR after discharge following the initial surgery was 9 days (range: 1–58 days). The remaining patients with complications did not require readmissions and were managed successfully during their initial admission itself before discharge. The median duration of hospital stay for patients with complications was 15 days (range: 3–154 days). The various reasons for UHR are given in Table 3. We analyzed to identify the factors that were contributing to the UHR. On univariate analysis, (Tables 1 and 2) factors which significantly seemed to contribute to the UHR were re-exploration in the immediate postoperative period following surgery, advanced stage, reconstruction with free flap, those undergoing surgery for BM-GBS primary, and patients undergoing major resections like segmental bone defects with major glossectomy. Multivariate analysis (Tables 1 and 2) showed that patients who underwent re-exploration in the immediate postoperative period (OR 7.9; 95% CI 4.09–15.59) and those with a "BM-GBS" primary (OR 2.89; 95% CI 1.24–6.73) contributed the most for UHR.

Patients in whom adjuvant treatment was indicated could receive them by 6 weeks, and in most patients, this was delayed by a week in those who had UHR.

Discussion

India's expenditure on public health is among the lowest in the world [11]. Only around 15% of the Indian population is covered by some health insurance, and most of these insurances do not address the complex nature of cancer treatment, which includes UHR [12]. This contributes to a high out-of-pocket expenditure, which is among the highest in Asia, that the patients have to incur [13]. Also UHR invariably delays the scheduled elective surgical procedures, as treatment to the morbidity of the

Table 2 Treatment related details

Factors	Unplanned hospital readmission (numbers (%)	No unplanned hospital readmission (numbers (%)	Univariate *p* value	Multivariate *p* value (OR,95%CI)
Surgery for primary				
WE*	4 (10%)	281 (36.8%)	0.016	-
WE + marginal Mandibulectomy	5 (12.5%)	79 (10.3%)		
WE + segmental resection	22 (55%)	279 (36.5%)		
Major glossectomy	6 (15%)	88 (11.5%)		
Alveolectomy	3 (7.5%)	37 (4.8%)		
Surgery for neck (neck dissection)				
Ipsilateral	28 (70%)	568 (74.3%)	0.274	–
Bilateral	11 (27.5%)	133 (17.4%)		
Completion	0	9 (1.2%)		
None	1 (2.5%)	53 (7.1%)		
Reconstruction				
None free flap (Primary closure/pedicled/local flaps)	18 (45%)	436 (57.1%)	0.133	–
Free flap	22 (55%)	328 (42.9%)		
Duration of surgery				
≤4 Hours	5 (12.5%)	274 (35.9%)	0.002	–
>4 Hours	35 (87.5%)	490 (64.1%)		
Re-exploration				
Yes	18 (45%)	71 (9.3%)	< 0.001	< 0.001
No	22 (55%)	693 (90.7%)		7.9 (4.09–15.59)
Duration of hospital stay				
≤10 days	17 (42.5%)	406 (53.1%)	0.189	–
>10 days	23 (57.5%)	358 (46.9%)		

*WE wide excision

readmitted patients takes precedence. Hence it is important for hospitals to report their UHR and also identify the factors contributing to it, so that the number of readmissions can be minimized. As UHR is an important indicator of the quality of patient care provided by a hospital, there has been a recent interest across all specialties in analyzing their readmission rates [14]. To the best of our knowledge, there is no literature till date on UHR rates for patients undergoing treatment for OSCC from our country including our center.

Our center's UHR rate of 5% is comparable with the published literature on readmissions following surgery for head and neck cancers [15–18]. The reasons for readmissions and their management have been listed in Table 3. Factors that were found to be contributing to the readmissions were re-exploration after initial surgery, advanced stage, those undergoing extensive resections (like segmental bone defects and major glossectomy) lasting over 4 h, and patients with BM-GBS subsite primary. Identifying these factors predisposing to UHR is important to device appropriate risk reduction measures like intense monitoring of these patients, delayed initial discharge, and better supportive measures like nutrition, pre-operative optimization.

Re-Exploration Following Initial Surgery

A total of 89 patients (11%) underwent re-exploration for various reasons in the immediate postoperative period (Table 3). We found re-exploration in the postoperative period to be a significant predictor of UHR; it was significant on both univariate and multivariate analysis. The common causes for re-exploration in our cohort were either a hemorrhagic event (hematoma/active bleeding) or flap related issues like partial or complete flap necrosis. Although few prior studies have shown these two factors to be related to readmissions, direct cause to effect relationship between initial re-explorations and readmission has not been demonstrated previously [10, 19].

Oral Cavity Subsite

The subsite of primary cancer within the oral cavity was the second significant predictor of UHR. In our cohort, primary cancer of the BM-GBS was significantly associated with UHR both on univariate and multivariate analysis. Previous studies in literature, which included head and neck cancers from all sites, have also mentioned the influence of the site of primary on UHR

Table 3 Overall complications, re-explorations, and unplanned hospital readmissions (UHR) related details

Factors	Numbers (%)
Overall complications ($n = 183$)	
Orocutaneous fistula (OCF)	75 (9.3%)
Flap related issues	32 (4%)
Wound-related issues	41 (5%)
Systemic issues	11 (1.4%)
Chest infection	7 (0.9%)
Others	15 (1.9%)
30-day mortality	3 (0.3%)
Reasons for exploration ($n = 89$)	
Hematoma/bleeding	24 (27.3%)
Flap issues	55 (62.6%)
OCF	7 (7.9%)
Others	2 (2.2%)
Reasons for readmission ($n = 40$)	
Wound infection	7 (17.5%)
Chest infection	2 (5%)
OCF	10 (25%)
Flap issues	11 (27.5%)
Hematoma/bleeding	3 (7.5%)
Others	7 (17.5%)
Management of reasons for readmission ($n = 40$)	
Conservative	15 (37.5%)
Debridement/surgery/re-exploration	23 (57.5%)
New flap	2 (5%)
Time to readmission from discharge after initial surgery	Median: 9 days (range: 1–58 days)
Duration of hospital stay	
Overall	Median: 10 days (range:2–154 days)
With complications	Median: 15 days (range:3–154 days)
With re-exploration	Median: 17 days (range: 6–154 days

[17, 20]. These studies have pointed out larynx and oropharynx as high-risk subsites for readmissions. However, a similar predilection for an oral cavity subsite for UHR has not been shown before. A plausible explanation of this finding in our study could be due to the fact that the number of patients with BM-GBS cancer was more compared with tongue-FOM and also the number of patients with BM-GBS primary presenting with advanced disease was much more in comparison with tongue-FOM ($p < 0.001$). Most of the BM-GBS primaries necessitated extensive resection and reconstruction which may be contributing to the postoperative morbidity and subsequently to the UHR.

Advanced Stage

Patients presenting with advanced staged disease were more likely to have UHR, in our study. This was also reported by Offodille et al. [18] wherein they found pathological T4 to be an independent risk factor on multivariate analysis. Luryi et al. [15] in their study of 21,681 oral cavity malignancy patients from the NCDB also concluded that patients with T3/T4 disease had a higher risk for readmission. This finding can be explained by the fact that an advanced stage disease would have required a more extensive resection ($p = 0.008$) and a complex reconstruction; these surgeries will take longer hours (> 4 h, $p = 0.001$), thus increasing the possibility of a complication and hence readmission. This impact of advanced stages on readmissions has also been seen in other sites apart from head and neck, as reported by Yermilov et al. for pancreaticoduodenectomy [21].

Reconstruction of Surgical Defects with Free Flaps

Ghiam et al., in their study of 18,121 head and neck cancer patients, showed that patients undergoing laryngectomy and free flap procedures were at significant risk for readmission. However, the association of the risk of readmission with free flap procedure has not been consistent [7]. In our study, there was a trend toward increased UHR in patients undergoing free flap procedure but not statistically significant. This could be

due to the fact that though the maximum type of reconstruction was done with free flaps ($n = 350$, 43.5%), a similar proportion of patients underwent reconstruction with pedicled flap ($n = 175$, 21.7), local flap ($n = 55$, 6.8%), and primary closure ($n = 212$, 26.3%). The UHR in patients undergoing free flaps were only slightly more than those undergoing other types of reconstruction.

Others

Some of the other factors such as age, gender, comorbidities, previous treatment received, and neck dissection did not have a significant association with UHR. While age overall did not show a significant association with the UHR, one observation was that patients aged > 75 years had a higher chance of UHR (3/14, 221.4%). Previous studies are divided in identifying age and comorbidities as potential risk factors. While Bur et al. in their retrospective review found age, pneumonia, diabetes, venous thromboembolism, and long-term corticosteroid use to be independently associated with readmissions, Offodille et al did not find this correlation [16, 18]. Patients receiving some form of prior treatment like surgery, radiation with/without chemotherapy, or induction chemotherapy were also not seen to be at a higher risk for readmissions. We attribute this to a more intense postoperative monitoring of these patients as a protocol in our hospital including a delayed initial discharge. Luryi et al. showed an association between duration of hospital stay and UHR. In our cohort, the duration of hospital stay of > 10 days showed a significant association with UHR on only univariate analysis.

Our study is the probably the first of its kind to report regarding UHR in OSCC from India and identify the factors predisposing to UHR in a large cohort of patients from a single center. However, there are certain limitations, firstly its retrospective nature. Second, few of the events that we looked at were not entirely mutually exclusive. For example, an orocutaneous fistula could have led to a wound infection or vice versa and which factor was the predisposing cause of readmission wasn't clear in few of the patients. Thirdly, we do not have data regarding our patients getting readmitted in some other institution due to a complication, although in our experience, that number if at all would be extremely low. Also, we have not reported the financial aspects related to UHR. Prospective studies are needed to validate our results and further analyze the impact of readmissions on outcomes in terms of cost, treatment delays and survival.

Conclusion

UHR is an underreported entity in the healthcare system across the Indian subcontinent. It is essential to report and identify factors predisposing to the same. UHR following surgery for OSCC was 5% in our study. Patients at maximum risk for UHR were those undergoing re-exploration in the immediate postoperative period and those with BM-GBS tumor site. Other factors that could possibly contribute to UHR were those patients presenting with advanced stage disease, undergoing major resections and complex (free flap) reconstructions, lasting for >4 h. By identifying a subset of patients more prone to UHR, appropriate measures and protocols can be set in place to mitigate these factors in order to reduce these numbers and the possible effects attributable to UHR.

Acknowledgments Dr. Atanu Bhattacharjee, Assistant Professor, Department of Biostatistics, ACTREC, Navi Mumbai, Maharashtra, India.

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Manuscript reviewing: All Authors.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval A retrospective clinical audit of an existing database. No patient contact was made. All patients received the standard of care for their condition and were as per the ethical standards.

Informed Consent No identifying information about participants is available in the article. However, all patients have given consent for the treatment they have received.

Conference Presentation This was presented as a poster at the FHNO 2019 meeting held in Chennai between October 11 and 13, 2019.

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