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Postoperative Care Fragmentation and 30-Day Unplanned Readmissions After Head and Neck Cancer Surgery

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Abstract

Objectives—Post-discharge care fragmentation, readmission to a hospital other than the one performing the surgery, hasn't been described in head and neck cancer patients. We sought to determine the frequency, risk factors, and outcomes for head and neck cancer patients experiencing post-discharge care fragmentation.

Design—Retrospective cohort study

Methods—We analyzed patients in the 2008–2010 California State Inpatient Database with a 30-day unplanned readmission following head and neck cancer surgery. The frequency of post-discharge care fragmentation, patient- and hospital-level risk factors for care fragmentation, readmission diagnosis, and readmission outcomes were determined.

Results—Of 561 patients with a 30-day unplanned readmission, 210 (37.4%) were readmitted to a hospital other than the one performing the surgery. Surgical hospitalization length of stay 15 days (OR 1.87; 95% CI 1.13–3.10) and discharge to a care facility (OR 2.85; 95% CI 1.77–4.58) were associated with care fragmentation. Overall, 39.8% of unplanned 30-day readmissions (223/561) were treatment complications and 30.9% of treatment complication readmissions (69/223) occurred at a non-index hospital. Patients with post-discharge care fragmentation had a 2.1-fold increased risk of in-hospital mortality within 30 days of readmission compared to patients readmitted to the index hospital (95% CI 1.04–4.26).

Conclusions—Post-discharge care fragmentation following head and neck cancer surgery is common, as 37% of readmitted patients, and 31% of patients readmitted with a treatment complication, are readmitted to a hospital other than the surgical hospital. Head and neck cancer

patients experiencing care fragmentation are at increased risk of in-hospital mortality within 30 days of readmission.

Keywords

readmissions; unplanned readmission; quality; care fragmentation; State Inpatient Database; head and neck cancer; healthcare policy

Introduction

Care fragmentation has been defined as the interruption of continuity of care, with provision of care by disparate healthcare providers without integrating clinical information¹. Fragmented care can occur in the outpatient setting², the inpatient setting for patients with chronic conditions admitted to different hospitals for episodic care¹, and in the postoperative period for patients readmitted to a hospital other than the one performing the surgery^{3,4}. For surgical patients, post-discharge care fragmentation has been defined as an unplanned readmission to a hospital other than the hospital at which the surgical procedure was performed³. Postoperative care fragmentation has been reported in 25% of general surgery readmissions^{3,5}. Care fragmentation was associated with worse outcomes across a variety of contexts^{1,6,7}, and in general surgery patients is associated with 33–50% increased relative risk of mortality^{3,4}.

A gap exists in the head and neck cancer literature regarding postoperative care fragmentation upon readmission, specifically its incidence, factors associated with its occurrence, and its consequences on patient outcomes. Head and neck cancer patients, because of the relative rarity of their disease, altered breathing and swallowing physiology, potentially complicated reconstruction, and postoperative wound care, may be at risk for suboptimal outcomes in the setting of postoperative care fragmentation.

To provide insight into postoperative care fragmentation following inpatient head and neck cancer surgery, we analyzed data from the State Inpatient Database (SID) from California. The California SID, available through the Healthcare Cost and Utilization Project (HCUP)⁸, was chosen because it allows tracking of readmissions across hospitals (unlike single institution studies), includes information about the readmission diagnosis and hospital course (unlike the National Cancer Database), includes different types of hospitals (unlike University Health Consortium data), includes patients of all ages and types of payers (unlike Surveillance, Epidemiology, End, and Results-Medicare data), and captures readmissions beyond 30 days postoperatively (unlike the National Surgical Quality Improvement Program).

Using the California SID to analyze a cohort of head and neck patients undergoing surgery with a 30-day unplanned readmission, we attempted to answer the following questions about postoperative care fragmentation: how common is it, what factors are associated with its occurrence, do readmission diagnoses vary between patients who do or don't experiencing care fragmentation, and what effect does it have on patient outcomes?

Materials and Methods

Data Source and Study Population

The study was granted exempt status by the Washington University School of Medicine Institutional Review Board. Data was obtained from the California SID from 2008–2010 as described previously⁹. The SID is part of a family of databases maintained by the HCUP and sponsored by the Agency for Healthcare Research and Quality⁸. The California SID was chosen because it contains encrypted personal identifiers that allowed longitudinal follow-up. Information on structural hospital characteristics is publically available for California, which allowed analysis of hospital characteristics. Data on hospital characteristics were obtained from the Hospital Annual Utilization Data available through the California Office of Statewide Health Planning and Development and linked to SID data by hospital identifier¹⁰.

International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) procedure codes were used to identify the first discharge for patients 18 years of age undergoing an inpatient otolaryngology surgery in California from 2008–2010 (i.e. the index surgical hospitalization)⁹. This cohort was filtered using ICD-9-CM diagnosis codes to identify patients with surgery for cancer of the lip, oral cavity, oropharynx, hypopharynx, larynx, unknown primary, or major salivary gland who had a readmission within 30 days of the surgical hospitalization discharge: 761 patients were identified (eTable 1). The following patients with only a planned 30-day readmission were excluded: primary readmission diagnosis of encounter for chemotherapy (n=38) or thyroid cancer (n=6), and readmission diagnosis of head and neck cancer in patients who underwent surgery on the day of the readmission and were not transferred from another acute care hospital or admitted via the emergency department (n=154). The final cohort was composed of 561 patients with a 30-day unplanned readmission following head and neck cancer surgery.

Study Variables

Patient-level variables included demographics, median household income for patient zip code (a proxy for socioeconomic status), primary payer, comorbidities, admission source, length of stay (LOS), and discharge destination. Comorbidities were identified using the Elixhauser Comorbidity measure for administrative data¹¹. Discharge destination was categorized using the DISPU uniform variable into home (routine), home with home health care, care facility (skilled nursing facility, intermediate care facility, other facility, or short term hospital), or other (against medical advice or unknown).

Hospital-level variables were chosen based on prior research^{9,12–14} and included hospital size, teaching status, ownership, and hospital disproportionate share (DSH) index. Hospital ownership was classified as public, nonprofit, for profit/investor, or University of California. Hospital size was categorized as small (<150 beds), medium, (150–400 beds), or large (>400 beds)¹⁵. DSH hospitals were identified based on Medicare disproportionate share index¹⁶.

The index hospital/surgery was identified based on the first coded surgical treatment of the patient's malignancy during the time period of data analysis (2008–2010), which may have been the initial surgical treatment, a subsequent surgery, or a salvage procedure for

recurrent/persistent disease. The hospital of readmission was defined as the hospital of discharge from the readmission so as to maximize the opportunity for care continuity (e.g. a patient admitted to a non-index hospital and transferred to the surgical hospital for the remainder of the hospitalization was considered readmitted to the index hospital). Post-discharge care fragmentation was defined as readmission to a hospital that differed from the hospital of the index surgery.

Readmission diagnosis was determined using the primary diagnosis code, which is the primary reason for admission assigned at discharge. Readmission diagnoses were categorized into treatment complications, medical diagnoses, or cancer diagnoses. Thirty-day mortality from the time of readmission was determined using the timing (DaysToEvent) and died variables. The SID California captures in-hospital mortality only.

Outcome Measures

The primary outcome measure was the incidence of 30-day unplanned readmission to a hospital other than the one that performed the index surgery (i.e. non-index hospital). Secondary outcomes included in-hospital mortality within 30 days of readmission, readmission length of stay, and discharge destination following readmission.

Statistical Analysis

The proportion of patients with an unplanned 30-day readmission to the non-index hospital was calculated. Univariable logistic regression analysis was performed to identify patient-level and hospital-level variables, and readmission diagnoses associated with care fragmentation. The 30-day in-hospital mortality rate, readmission LOS, and discharge destination following readmission was compared for patients who did and did not experience care fragmentation. Statistical tests were 2-sided and statistical significance was indicated by p -values < 0.05 . Odds ratios (ORs) are presented with 95% confidence intervals (CIs). Statistical analysis was performed in SAS Enterprise Guide 5.1 (SAS Institute, Cary, NC).

Results

Incidence of Post-discharge Care Fragmentation

There were 5560 patients with inpatient surgery for head and neck cancer in California between 2008–2010, and 561 unplanned readmissions within 30 days of the first coded surgical procedure. Of the 561 unplanned readmissions, 210 (37.4%) occurred at a hospital other than the one that performed index surgery (non-index hospital readmission, Figure 1).

Risk Factors for Post-Discharge Care Fragmentation

The readmission cohort characteristics are presented in Table 1. Compared to patients readmitted to the index hospital, there was a non-statistically significant trend for elderly patients to be readmitted to a different hospital (OR 1.38; 95% CI 0.98–1.95). Of the comorbidities, there was a statistically significant increased risk of readmission to a different hospital in patients with peripheral vascular disease (OR 2.44; 95% CI 1.17–5.08) and a non-statistically significant trend for depression (OR 1.70; 95% CI 0.96–2.99), renal failure (OR 1.74; 95% CI 0.92–2.32), and weight loss (OR 1.70; 95% CI 0.96–3.00).

The characteristics of the index hospital in which the surgery was performed and the details of the index hospitalization are shown in Table 2. Patients having their surgery at a medium-sized hospital were 41% less likely to experience care fragmentation when readmitted than patients whose surgery was at a large hospital (OR 0.59; 95% CI 0.40–0.86). Patients who had a longer index hospital LOS were more likely to experience care fragmentation on readmission (OR 1.87; 95% CI 1.13–3.10 for index LOS ≥ 15 days). Discharge destination was also associated with care fragmentation; patients discharged home from the index admission with home health (OR 1.47; 95% CI 1.00–2.18) or to a care facility (OR 2.85; 95% CI 1.77–4.58) had a higher risk of readmission to a non-index hospital compared to those discharged to home.

Readmission Diagnosis

The readmission diagnosis category is shown in Figure 2. Surgical treatment complications accounted for 39.8% (n=223) of the 30-day unplanned readmission diagnoses. Treatment complications were surgical site infection (7.3% of all readmissions; n=41), wound dehiscence or fistula (6.6%; n=37), postoperative bleeding (4.8%; n=27), gastrostomy tube complication (4.6%; n=26), tracheotomy tube complication (3.6%; n=20), and other surgical complications (12.8%; n=72) (e.g. complications not otherwise specified, nutrition/failure to thrive, etc). Of the unplanned readmissions with a primary medical diagnosis (46.5% of readmissions; n=261), the most common diagnoses were pulmonary (14.6% of all readmissions; n=82), gastrointestinal (7.3%; n=41), and sepsis (5.7%; n=32). Overall, 13.7% of unplanned readmissions (n=77) had a readmission diagnosis identical to the original head and neck cancer diagnosis. Since we attempted to exclude patients with a planned readmission, it is likely that these patients with a head and neck cancer readmission diagnosis have non-specific coding as the reason of readmission.

The readmission diagnosis differed for patients experiencing care fragmentation upon readmission relative to patients who were readmitted to the index hospital (Figure 3). Of the 223 unplanned readmissions due to treatment complications, 30.9% (n=69) occurred at a non-index hospital. Of the 261 unplanned readmissions due to a medical diagnosis, an even higher percentage of readmissions (46.0%; n=120) occurred at a non-index hospital. Patients readmitted with a medical diagnosis were more than twice as likely to be readmitted to a non-index hospital as patients with a cancer diagnosis (OR 2.25; 95% CI 1.29–3.93), and almost two times as likely to be readmitted to a non-index hospital as patients readmitted with a treatment complication (OR 1.88, 9% CI 1.29–2.74).

Route of Readmission

The route of readmission varied for patients readmitted to the same or a different hospital. Eighty-two percent (172/210) of patients readmitted to a non-index hospital were readmitted via the emergency department compared to 61.8% (217/351) of patients readmitted to the index hospital (OR 3.43, 95% CI 2.17–5.41). The rate of readmission via transfer from a skilled nursing care facility or other acute care hospital was similar for patients readmitted to a non-index hospital (4.8%, 10/210) and index hospital (3.7%, 13/351).

Outcomes Following Postdischarge Care Fragmentation

The outcomes for patients experiencing care fragmentation upon readmission are displayed in Table 3. The all-cause 30-day in-hospital mortality following unplanned readmission was 5.9% (n=33). Of the patients readmitted to a non-index hospital, the in-hospital mortality rate within 30-days of the unplanned readmission was 8.6% (n=18). This represents a 2.1-fold increased risk of dying within 30 days of the unplanned readmission if the patient experienced care fragmentation (95% CI 1.04–4.26). The crude excess mortality for patients experiencing care fragmentation upon readmission was 4.3% (95% CI 0.0%–8.6%). The median readmission LOS was 5 days (range 0–234 days), and was not significantly different for patients readmitted to a non-index hospital compared to readmission to the index hospital (p=0.21). Twenty-five percent of the patients readmitted to a non-index hospital were subsequently discharged to a care facility (i.e. another acute care hospital, skilled nursing facility, intermediate care facility, or other facility), which represents 2.10-fold increased risk of discharge to a care facility compared to patients readmitted to the index surgical hospital (95% CI 1.33–3.30).

Discussion

This study is the first to examine the incidence, risk factors, diagnoses, and outcomes following post-discharge care fragmentation in head and neck cancer patients with a 30-day unplanned readmission. The study had three major findings: (1) postoperative care fragmentation is common, even for treatment-related complications; (2) elderly patients, patients with a prolonged index hospitalization, and those discharged to a skilled nursing facility are at highest risk of care fragmentation; and (3) postoperative care fragmentation upon readmission is associated with an increased risk of 30-day mortality.

Incidence of Post-discharge Care Fragmentation and Readmission Diagnosis

Postoperative care fragmentation is common for unplanned readmissions following head and neck cancer surgery, with an incidence of 37.4% in this study. This rate is slightly higher than a prior study examining a heterogeneous group of patients undergoing inpatient otolaryngologic surgery¹⁷, although that study included planned readmissions. The rate of post-discharge care fragmentation in this study is similar to that following general surgery procedures^{3–5}.

Even more surprising than the overall rate of care fragmentation was the rate of care fragmentation for patients readmitted with a surgical treatment complication. In this study, one-third of patients readmitted with a treatment complication were readmitted to a hospital other than the one that performed the original surgery. Given the relative unfamiliarity to most non-otolaryngologists of caring for the postoperative head and neck cancer patient, this high rate of care fragmentation is potentially concerning and an area that can be targeted for improvement.

Variables Associated with Increased Risk of Postoperative Care Fragmentation

Certain patient-level variables including increased age and discharge destination were associated with an increased risk of postoperative care fragmentation. Elderly patients have

previously been highlighted as at-risk for care fragmentation in general surgery^{3,4}. It may be that these patients lack the support or transportation abilities to get return to their index hospital for readmission care. Patients discharged to a skilled nursing facility had a nearly 3-fold increased risk of readmission to a non-index hospital. It is unknown why discharge to a skilled nursing facility would be associated with a higher risk of postdischarge care fragmentation. The role of post-discharge care destination as a risk factor for readmission for otolaryngology patients has been described¹⁷, and these data provide further support for focusing efforts at increasing continuity across this post-discharge transition.

Certain characteristics of the index surgical index hospital were related to the risk of postoperative care fragmentation. It is commonly stated in single institution retrospective series about readmission that patients having surgery at an academic center are readmitted to that hospital for postoperative issues^{10,18,19}. Our findings indicate otherwise, as patients who had surgery at an academic center did not have a lower rate of postoperative care fragmentation. This is consistent with the general surgery literature, as nearly 30% of readmissions following oncologic surgery at a tertiary care academic center occurred elsewhere⁵.

Consequences of Post-discharge Care Fragmentation

In this study, care fragmentation upon unplanned readmission was associated with an increased risk of in-hospital mortality within 30-days of readmission. Although this crude excess risk of mortality was small (4.3%), it represents a 2-fold increased risk of dying within 30-days of the readmission for patients readmitted to the non-index hospital compared to patients readmitted to the index hospital. The numbers in this study are small and require confirmation in a larger cohort, but are concordant with the general surgery literature. Across a variety of surgical procedures, readmission to a hospital other than where the surgery occurred was associated with worse survival^{3,4}. This finding persisted after adjusting for distance from the hospital, suggesting that it is the care fragmentation, not unmeasured confounding variables, driving the poor outcome^{3,4}.

Practical Implications for Improving the Continuity of Care

These data require validation in a larger cohort and in other states. However, it is apparent that unplanned readmissions outside of the index institution, even for treatment-related complications, and even for patients treated at academic centers, are common. Increasing sensitivity and awareness of care fragmentation following head and neck cancer surgery, both the magnitude of the problem and its implications for patient outcomes, represent an important first step in its prevention. Solutions might be challenging and variable based on location and environment of the index treating hospital. Strategies to reduce care fragmentation for a hospital that is small and rural may be very different than strategies for a hospital that is large and urban.

Limitations

This administrative data-based study is limited by the accuracy of ICD-9-CM diagnosis codes, especially for minor complications²⁰. Readmission diagnoses in administrative data do not always correlate with the true reason for readmission^{21,22}. The presence of

unmeasured confounding variables associated with both the predictor (readmission to a non-index hospital) and outcome (mortality) cannot be excluded. A number of factors related to the decision of readmission destination, such as patient preference, means of transportation, proximity to the index hospital, availability of a head and neck surgeon on staff, patient insurance status, or acuity of the readmission diagnosis could not be answered with this study. Given the number of deaths in the entire cohort, we were unable to determine whether there is an increased risk of mortality upon readmission to a non-index hospital exists for patients with a medical diagnosis compared to a surgical complication. A future study using data from multiple states comparing rates of care fragmentation across states (and regions) and including more patients would be worthwhile. A prospective multi-institutional study would also potentially provide more detail into the qualitative determinants of post-discharge readmission destination. Although we attempted to distinguish between planned and unplanned readmissions, it is possible that we included some patients with a planned readmission excluded some patients with an unplanned readmission.

Conclusions

Postoperative care fragmentation upon unplanned readmission following head and neck cancer surgery is common, as 37% of patients, and 31% of patients readmitted with a treatment complication, are readmitted to a hospital other than the one where the index operation was performed. Patients with a prolonged index LOS and those discharged to a care facility are at highest risk of care fragmentation upon readmission. Postsurgical care fragmentation in head and neck cancer patients is associated with an increased risk of 30-day in-hospital mortality. Further investigation into the causes, outcomes, and strategies for the prevention of postoperative care fragmentation in head and neck cancer patients is warranted.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1. Incidence of Post-Discharge Care Fragmentation

Percentage of patients readmitted to the same hospital that performed the index surgery (No care fragmentation) or a different hospital than the one performing the index surgery (Care fragmentation).

Figure 2. Readmission Diagnoses for Patients with 30-day Unplanned Readmission
Percentage of patients with 30-day unplanned readmission based on readmission diagnosis category.

Figure 3. Proportion of patients readmitted to index vs non-index hospital

Proportion of patients readmitted to index vs non-index hospital based on category of readmission diagnosis. Overall 561 patients were readmitted, 351 to the index hospital and 210 to the non-index hospital.

Table 1

Patient Characteristics

Patient Variable	Total Patients (n=561)		Readmitted to Index Hospital (n=351)		Readmitted to non-Index Hospital (n=210)		Odds Ratio	95% CI
	#	(%)	#	(%)	#	(%)		
Head and Neck Subsite								
Oral Cavity	148	26.4	82	23.4	66	31.4	1 (Ref)	NA
Oropharynx	110	19.6	71	20.2	39	18.6	0.68	0.41–1.13
Hypopharynx	41	7.3	25	7.1	16	7.6	0.80	0.39–1.61
Larynx	164	29.2	108	30.8	56	26.7	0.64	0.41–1.02
Unknown Primary	70	12.5	44	12.5	26	12.4	0.73	0.41–1.32
Major Salivary Gland	28	5.0	**	**	**	**	**	**
Age >=65	306	54.5	181	51.6	125	59.5	1.38	0.98–1.95
Male Gender	381	67.9	236	67.2	145	69.0	1.09	0.75–1.57
Race								
White	375	66.8	228	65.0	147	70.0	1 (Ref)	NA
Black	42	7.5	24	6.8	18	8.6	1.16	0.61–2.22
Hispanic	93	16.6	63	17.9	30	14.3	0.74	0.46–1.20
Other	51	9.1	36	10.3	15	7.1	0.65	0.34–1.22
Median household income of zipcode (quartile)								
1	148	26.4	87	24.8	61	29.0	1 (Ref)	NA
2	121	21.6	70	19.9	51	24.3	1.04	0.64–1.69
3	137	24.4	86	24.5	51	24.3	0.85	0.53–1.36
4	146	26.0	101	28.8	45	21.4	0.64	0.39–1.03
Missing income	**	**	**	**	**	**	**	**
Insurance								
Private	146	26.0	97	27.6	49	23.3	1 (Ref)	NA
Medicare	302	53.8	176	50.1	126	60.0	1.42	0.94–2.14
Medicaid	84	15.0	56	16.0	28	13.3	0.99	0.56–1.75

Patient Variable	Total Patients (n=561)		Readmitted to Index Hospital (n=351)		Readmitted to non-Index Hospital (n=210)		Odds Ratio	95% CI
	#	(%)	#	(%)	#	(%)		
Other	29	5.2	**	**	**	**	**	**
Anemia [#]	102	18.2	60	17.1	42	20.0	1.21	0.78–1.88
Chronic Lung Disease ^{&}	143	25.5	89	25.4	54	25.7	1.02	0.69–1.51
Depression	53	9.4	27	7.7	26	12.4	1.70	0.96–2.99
Diabetes Mellitus	121	21.6	71	20.2	50	23.8	1.23	0.82–1.86
Peripheral Vascular Disease	31	5.5	13	3.7	18	8.6	2.44	1.17–5.08
Renal failure	40	7.1	20	5.7	20	9.5	1.74	0.92–3.32
Weight loss	53	9.4	27	7.7	26	12.4	1.70	0.96–3.00

Abbreviations: CI = confidence interval; Ref = reference; PVD = peripheral vascular disease

^{**} Cells with < 10 data points are censored per HCUP policy to protect patient identity.

[#] Anemia includes blood loss and deficiency anemia.

[&] Additional comorbidities examined using the Elixhauser Comorbidity measures for administrative data were not statistically significant.

Table 2

Index Hospital Characteristics and Hospital Course

Patient Variable	Total Patients (n=561)	Readmitted to Index Hospital (n=351)	Readmitted to non-Index Hospital (n=210)	Odds Ratio	95% CI
#	(%)	#	(%)	#	(%)
Index Hospital Type					
Non-profit	296	52.8	190	54.1	50.5
Public	79	14.1	56	16.0	23
Investor	48	8.6	29	8.3	13.8
University	128	22.8	76	21.7	24.8
# of Beds					
>=400	498	88.8	342	97.4	74.3
151-399	237	42.2	180	51.3	27.1
<=150	26	4.6	11	3.1	7.1
Teaching Hospital	272	48.5	164	46.7	51.4
Disproportionate Share Hospital	245	43.7	152	43.3	44.3
Index Length of Stay (days)					
<=3	142	25.3	100	28.5	20.0
4-14	294	52.4	181	51.6	53.8
>=15	125	22.3	70	19.9	26.2
Index Discharge Destination					
Home	269	48.0	188	53.6	38.6
Home with homecare	188	33.5	115	32.8	34.8
Care Facility	98	17.5	44	12.5	25.7
Other	**	**	**	**	**

Abbreviations: CI = confidence interval; Ref = reference

Table 3**Outcomes Following Unplanned Readmission**

Outcome Measure	Mortality within 30 days of Unplanned Readmission		Readmission Length of Stay		Readmission Discharge to Care Facility	
	#	(%)	Median # (days)	(min-max) (days)	#	OR (95%CI)
Readmitted to Index Hospital (n=351)	15	4.27	5	0-234	51	1 (Ref)
Readmitted to non-Index Hospital (n=210)	18	8.57	4	0-86	48	2.05 (1.28-3.27)