Oral Oncology 71 (2017) 106–112

Contents lists available at ScienceDirect

Oral Oncology

journal homepage: www.elsevier.com/locate/oraloncology

Predictors of readmissions after head and neck cancer surgery: A national perspective

Michelle M. Chen [a], Ryan K. Orosco [a], Jeremy P. Harris [b], Julie B. Porter [c], Eben L. Rosenthal [a], Wendy Hara [b], Vasu Divi [a,*]

[a] Department of Otolaryngology-Head and Neck Surgery, Stanford University, 900 Blake Wilbur Drive, Third Floor, Stanford, CA 94305, USA
[b] Department of Radiation Oncology, Stanford University, 875 Blake Wilbur Drive, Rm CCG210 Clinic D, Stanford, CA 94305, USA
[c] Stanford Health Care, 875 Blake Wilbur Drive, Stanford, CA 94305, USA

ARTICLE INFO

Article history:
Received 14 February 2017
Received in revised form 14 June 2017
Accepted 15 June 2017

Keywords:
Head and neck cancer
Hospital readmission
Patient readmission
Patient discharge
Patient care
Laryngeal cancer
Oropharyngeal cancer
Oral cavity cancer
Hypopharyngeal cancer

ABSTRACT

Objectives: Surgical oncology patients have multiple comorbidities and are at high risk of readmission. Prior studies are limited in their ability to capture readmissions outside of the index hospital that performed the surgery. Our goal is to evaluate risk factors for readmission for head and neck cancer patients on a national scale.

Material and methods: A retrospective cohort study of head and neck cancer patients in the Nationwide Readmissions Database (2013). Our main outcome was 30-day readmission. Statistical analysis included 2-sided *t* tests, χ^2, and multivariate logistic regression analysis.

Results: Within 30 days, 16.1% of 11,832 patients were readmitted and 20% of readmissions were at non-index hospitals, costing $31 million. Hypopharyngeal cancer patients had the highest readmission rate (29.6%), followed by laryngeal (21.8%), oropharyngeal (18.2%), and oral cavity (11.6%) cancers ($P < 0.001$). Half of readmissions occurred within 10 days and were often associated with infections (27%) or wound complications (12%). Patients from lower household income areas were more likely to be readmitted (odds ratio [OR], 1.54; 95% confidence interval [CI], 1.16–2.05). Patients with valvular disease (OR, 2.07; 95% CI, 1.16–3.69), rheumatoid arthritis/collagen vascular disease (OR, 2.05; 95% CI, 1.27–3.31), liver disease (OR, 2.02, 95% CI, 1.37–2.99), and hypothyroidism (OR 1.30; 95% CI, 1.02–1.66) were at highest risk of readmission.

Conclusion: The true rate of 30-day readmissions after head and neck cancer surgery is 16%, capturing non-index hospital readmissions which make up 20% of readmissions. Readmissions after head and neck cancer surgery are most commonly associated with infections and wound complications.

Introduction

Hospital readmissions cost Medicare alone more than $17 billion annually in avoidable expenses, with over 17.5% of patients getting readmitted within 30-days of hospital discharge [1–3]. Only 10% of these Medicare readmissions are considered planned readmissions [1]. In order to encourage hospitals to reduce readmissions, the Affordable Care Act, which was passed in March 2010, created the Hospital Readmissions Reduction Program. Since October 2012, the Centers for Medicare and Medicaid Services (CMS) has levied a penalty on hospitals with readmissions in excess of the expected national rate. For fiscal year 2017, the penalties are expected to total $528 million, which is $108 million more than the prior year [4].

The current program targets six medical conditions. Initially, it targeted acute myocardial infarctions, heart failure, and pneumonia. In 2015, total knee and hip surgery and chronic obstructive pulmonary disease were added; and in 2017, coronary artery bypass surgery was added [2,3]. Preliminary data since the introduction of the program has shown a reduction in the rates of avoidable readmissions, making the expansion of this program increasingly likely [2]. Oncology patients in particular have high rates of readmission following discharge, making them a possible target of the program. The concept of avoidable admissions in also present in the CMS Oncology Care Model, piloted on July 1, 2016, which seeks to capture the rates of emergency department visits and readmissions during chemotherapy.

* Corresponding author.
E-mail address: vdivi@stanford.edu (V. Divi).

http://dx.doi.org/10.1016/j.oraloncology.2017.06.010
1368-8375/

Given the unique challenges faced by oncology patients, and head and neck cancer surgery patients in particular, there is a need to understand the risk factors for readmission so interventions can be effectively targeted and hospital benchmarks can be appropriately risk-adjusted. In addition, it is important for providers to understand the causes of these readmissions to help design programs that reduce avoidable readmissions. Prior studies on readmissions in otolaryngology are primarily institutional studies that are unable to capture readmissions that occur outside of a single institution. The purpose of our study was to evaluate the causes of and risk factors for readmission in head and neck cancer surgery patients utilizing a national database that covers readmissions at both the index hospital and outside facilities. This database also captures socioeconomic and comorbidity data to allow for evaluation of patient-level characteristics that influence readmission.

Materials and methods

Our study was granted an exemption from our institutional review board. Patient data was drawn from the Healthcare Cost and Utilization Project's Nationwide Readmissions Database (NRD) from January 1, 2013 to December 31, 2013. The NRD is a database of all-payer hospital inpatient stays from 21 states that accounts for 49.1% of all United States hospitalizations [5]. This stratified sample can be used to produce nationally weighted estimates. In 2013, the NRD covered 14 million discharges, resulting in a nationally weighted sample of 36 million discharges.

All adult patients (age $\geq$ 18) with a primary diagnosis of head and neck cancer were chosen based on their *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) diagnosis codes for oral cavity cancer (141.1–141.4, 141.8–141.9, 143.0–145.9), oropharyngeal cancer (141.0–141.6, 146.0–146.9), hyopharyngeal cancer (148.0–148.9), and laryngeal cancer (161.0–161.9). We limited our cohort to those who had surgery for the primary site based on their ICD-9-CM procedure codes. We also limited our index hospitalizations from January 1, 2013 to November 30, 2013, in order to ensure we were able to capture all 30-day readmissions. We excluded patients that died during the index hospitalization and any records that were combined transfer records that combined multiple hospitalizations into one.

Demographic and socioeconomic status variables included age, sex, patient location, state residence, insurance status, household income, comorbidities, and number of chronic conditions. Age was grouped into four categories (18–49, 50–59, 60–69, and $\geq$70 years of age). Patient location was grouped into large metropolitan areas (populations $\geq$ 1 million), small metropolitan areas (populations from 50,000 to 999,999), and micropolitan and other areas. State residence was a binary characteristic that depended on whether the patient was a resident of the state of the index hospitalization. Insurance status was categorized as Medicare, Medicaid, private insurance, self-pay, and other (including no charge). Income was the median household income for the patient's ZIP code and grouped into quartiles ($1–$37,999; $38,000–$47,999; $48,000–$63,999; and $64,000 or more).

Comorbidity measures were identified by the Agency for Healthcare Research and Quality's comorbidity software that identifies coexisting medication conditions that are likely present prior to hospital admission. The comorbidity measures included alcohol abuse, anemia (chronic blood loss and deficiency anemias), congestive heart failure, coagulopathy, depression, diabetes (complicated and uncomplicated), pulmonary disease (chronic lung disease and pulmonary circulation disorders), drug abuse, hypertension (complicated and uncomplicated), hypothyroidism, liver disease, fluid and electrolyte disorders, obesity, renal failure, weight loss, valvular heart disease, peripheral vascular disease, rheumatoid arthritis/collagen vascular disease, other neurological disorders, and psychoses. Tobacco use was a binary characteristic created for any patient with an ICD-9-CM diagnosis code of tobacco use.

Clinical variables for index hospitalization included tumor site, use of a flap during the index surgery, hospital length of stay, discharge location, costs, and primary diagnosis on readmission. Tumor site was classified as oral cavity, oropharynx, hypopharynx, and larynx. Discharge location was grouped into home, home with home health, discharge to skilled nursing facility (SNF) or other facilities, and leaving against medical advice (AMA). Total costs were determined by total charges and hospital-specific cost to charge ratios. Primary diagnosis on readmission was based on ICD-9-CM diagnosis codes and grouped into twelve categories (infection, other medical, head and neck cancer, other head and neck, wound complication, hematoma/hemorrhage, tracheostomy complication, electrolyte/nutrition, gastrostomy complication, pulmonary embolism/deep venous thromboembolism/stroke, chemotherapy/radiotherapy, or pain). "Other medical" encompassed diagnoses such as cardiovascular (heart failure, atrial fibrillation, chest pain, cardiac arrest, coronary artery disease), pulmonary (dyspnea), psychologic (anxiety, depression), renal, gastrointestinal, and genitourinary disorders. "Other head and neck" included diagnosis codes referring to edema in the head and neck, laryngeal stenosis, vocal fold paralysis, foreign bodies in the head and neck, and other diseases of the head and neck not classified elsewhere. Infections of tracheostomy and gastrostomy sites were grouped under the tracheostomy and gastrostomy complication categories rather than under infection. Hospital level variables included hospital size, ownership, location, and teaching status. Hospital size is grouped into small, medium, and large based on bedside and hospital location with larger cut-offs for hospitals in urban locations. Hospital ownership was categorized into government, private non-profit, and private investor-owned hospitals. Hospital location was classified as large metropolitan area ($\geq$1 million residents), small metropolitan area (<1 million residents), and other (includes micropolitan and non-urban areas). Teaching status was divided into metropolitan non-teaching hospitals, metropolitan teaching hospitals, and non-metropolitan hospitals.

Our primary outcome of interest was 30-day readmission defined as any hospital admission that occurred within 30 days of discharge from the index hospitalization. All statistical analysis was performed using STATA/SE software (version 14.2; StataCorp, College Station, TX, USA). Bivariate analysis using chi-square and t tests were used to analyze our categorical and continuous variables, respectively. Multivariate logistic regression analysis was used to identify factors associated with 30-day readmission. Odds ratios (OR) and 95% confidence intervals (95% CIs) were calculated for the strength of association. All tests were 2-sided, and a P value < 0.05 was considered to be statistically significant.

Results

We identified a weighted total of 11,832 patients who had primary surgery for oral cavity, oropharyngeal, hypopharyngeal, and laryngeal cancer with a 30-day readmissions rate of 16.1%. Over half of these patients were readmitted through the Emergency Department and 20% were readmitted to a different hospital (Table 1).

Just over half (51%) of initial 30-day readmissions occurred within 10 days of hospital discharge (see Fig. 1). Other than a diagnosis of head and neck cancer, the most common primary diagnosis on 30-day readmission was an infectious etiology (23.5%) (Fig. 2). In the first 10 days after hospital discharge, nearly half of readmissions were infectious (27.2%), wound-related (11.9%), and