Predictive Factors of Blood Transfusion in Major Head and Neck Surgery

Dongmin C. Kim[1]; Gregory L. Barinsky, PharmD[1]; Roman Povolotskiy, MD[1]; Soly Baredes, MD[1]
Dylan F. Roden, MD MPH[1]; Richard C. Park, MD[1]

[1]Department of Otolaryngology, Rutgers New Jersey Medical School, Newark, NJ

Abstract

Objective: To investigate the risk factors, epidemiology, and outcomes of blood transfusion in patients undergoing major head and neck surgery.

Study Design: Retrospective database analysis.

Methods: The 2005-2018 National Surgical Quality Improvement Program (NSQIP) database was queried for all major head and neck surgeries performed by otolaryngologists (N=5,631). Cases were separated into patients who received and did not receive blood transfusions. Multivariate and univariate analysis were used to analyze the cases for demographics features, risk factors, and complications.

Results: A total of 5,631 cases met the inclusion criteria. 1,160 (20.6%) cases had undergone blood transfusions during major head and neck surgery and up to 72 hours postoperatively. Majority of the blood transfusion cohort were of ages 61-80 (50.8%), male (70.0%), white (62.4%), and had underwent laryngectomies (35.1%). The mean hospital length of stay was greater in the patients who received blood transfusions (14.4 vs 10.1; p<0.001). The blood transfusion cohort were more likely to be classified as Anesthesiologists (ASA) physical status class 3 or 4 (91.0% vs. 80.3%; p<0.001). The univariate analysis found the following to be significantly greater in patients who underwent blood transfusions: race (p<0.001), surgery type (p<0.001), anemia (66.9% vs. 32.3%; p<0.001), hypertension requiring medication (52.3% vs 48.9%; p=0.041), disseminated cancer (9.7% vs. 7.3%; p=0.01), open wound infection (5.2% vs. 2.8%; p<0.001), losing > 10% of body mass in the last 6 months (18.5% vs. 8.5%; p<0.001), bleeding disorders (3.9% vs. 2.7%; p=0.04), preoperative transfusions (1.4% vs. 0.3%; p<0.001), systemic sepsis (3.6% vs. 1.5%; p<0.001), and functional health status of 'dependent' (4.9% vs 3.3%; p=0.014). The blood transfusion group had significantly lower rates of obesity (12.2% vs. 21.5%; p <0.001). The multivariate logistic regression revealed female sex (OR 1.584; p<0.001), race black (OR 1.573; p<0.001), anemia (OR 3.893; p<0.001), weight loss >10% in the last 6 months (OR 1.907; p<0.001), and preoperative transfusions (OR 2.926; p=0.013) as independent predictors of blood transfusions during major head and neck surgery. The analysis showed obesity (OR 0.650; p<0.001) as a protector for blood transfusions. Binary logistic regression found significance for all complications with the exception of stroke with neurological deficit and DVT requiring therapy. All medical complications (OR 2.452; p<0.001), all surgical complications (OR 1.745; p<0.001), and all complications (OR 2.068; p<0.001) were significantly increased with blood transfusions in major head and neck surgery.

Conclusions: Our study allows otolaryngologists to enhance preoperative decision-making and post-operative care for patients who have blood transfusions. The analysis serves as a guide for risk factors and possible post-operative complications of blood transfusions.

Introduction

- There is a reported incidence in the literature of perioperative blood transfusions in major head and neck procedures of 12% to 84%.[1]
- Blood transfusions carry a significant risk in transmitting blood-borne viral pathogens[2] and increase risk of cancer through transfusion-related immunomodulation.[3-4]
- Our study aims to evaluate a national database to determine the predictors for blood transfusions following major head and neck surgical procedures.

Methods and Materials

Patient Database:

- Retrospective analysis of 2005-2018 American College of Surgeon's National Surgical Quality Improvement Program (ACS-NSQIP) database, which contains deidentified patient information and 30-day morbidity and mortality.
- Current Procedural Terminology (CPT) codes were used to identify cases undergoing major head and neck procedures. Cases not performed by otolaryngologists and missing primary outcomes were excluded.

Statistical Analysis:

- SPSS 23 (IBM, Armonk, New York) was used for data analysis.
- Cross tabulation, Pearson's chi square, Fisher's exact test, and binary logistic regression were conducted to evaluate associations with risk factors and postoperative blood transfusions.
- A p-value of <0.05 was determined to be statistically significant.

Results

- A total of 5,631 cases that underwent major head and neck procedures met the inclusion criteria. Of the final cohort, 1,160 (20.6%) cases had peri- or post-operative blood transfusions.
- **Table 1** displays patient demographics and surgery type.
- **Table 2** displays univariate analysis of patient comorbidities and complications.
- **Table 3** displays multivariate logistic regression analysis.

Table 1 – Patient Demographics and Surgical Type

Demographic	Blood Transfusion Yes	Blood Transfusion No	P- value
Age cohorts (%)			0.937
≤40 years	4.1	3.9	
41-60 years	37.9	38.4	
61-80 years	50.8	51.0	
>80 years	7.2	6.8	
Gender (%)			0.189
Male	70.0	72.0	
Female	30.0	28.0	
Race (%)			**<0.001**
White	62.4	69.7	
Black	17.0	8.7	
Other	7.8	7.2	
Unknown	12.8	14.4	
Surgery Type (%)			**<0.001**
Laryngectomy	35.1	41.8	
Glossectomy	10.4	16.2	
Composite resection	25.3	20.1	
Mandibulectomy	17.7	13.6	
Pharyngectomy	2.0	3.4	
Multiple types	9.6	4.8	

Table 2 – Patient Comorbidities and Complications

Variable	Blood Transfusion Yes	Blood Transfusion No	P-Value
Comorbidities (%)			
Obesity	12.2	21.5	**<0.001**
Anemia	66.9	32.3	**<0.001**
Hypertension	52.3	48.9	**0.041**
Disseminated cancer	9.7	7.3	**0.010**
Wound infection	5.2	2.8	**<0.001**
Weight loss	18.5	8.5	**<0.001**
Bleeding disorder	3.9	2.7	**0.040**
Preoperative transfusion	1.4	0.3	**<0.001**
Systemic Sepsis	3.6	1.5	**<0.001**
Dependent functional health status	4.9	3.3	**0.014**
Complications (%)			
Superficial SSI	8.4	5.9	**0.002**
Deep SSI	5.3	3.6	**0.014**
Wound Disruption	10.2	3.9	**<0.001**
Pneumonia	9.8	5.0	**<0.001**
Reintubation	3.4	1.8	**0.003**
Ventilatory dependency	9.2	2.6	**<0.001**
Cardiac Arrest	2.3	0.7	**<0.001**
Myocardial infarction	2.1	0.6	**<0.001**
Sepsis	5.0	2.9	**0.001**
Surgical complications overall	22.7	14.2	**<0.001**
Medical complications overall	14.8	11.6	**<0.001**
Overall complications	38.3	22.2	**<0.001**
Length of stay (mean days ± SD)	14.4±11.2	10.1±8.6	**<0.001**

Table 3 – Multivariate Logistic Regression - Odds of Transfusion

Variable	Odds Ratio	P-value	95% CI
Obesity	0.650	**<0.001**	0.524-0.806
Anemia	3.893	**<0.001**	3.339-4.539
Hypertension	1.096	0.241	0.940-1.278
Disseminated cancer	1.018	0.892	0.791-1.310
Wound infection	1.427	0.060	0.985-2.068
Weight loss	1.907	**<0.001**	1.554-2.341
Bleeding disorder	1.365	0.120	0.922-2.022
Preoperative transfusion	2.926	**0.013**	1.253-6.836
Systemic Sepsis	1.140	0.595	0.703-1.850
Dependent functional health status	0.910	0.610	0.633-1.308

Conclusions

- Patients with peri- and postoperative blood transfusions had increased surgical, medical, and overall complications.
- Anemia, greater than 10% weight loss, and preoperative transfusions were independent risk factors for blood transfusion during head and neck procedures.
- Obesity was protective of peri- and post-operative blood transfusions.
- These relationships allow otolaryngologists to enhance preoperative decision-making and post-operative care for patients who receive blood transfusions.

Contact

Richard C. Park, MD
Department of Otolaryngology- Head and Neck Surgery
Rutgers New Jersey Medical School
cwp39@njms.rutgers.edu

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