

Thrombocytopenia and Thrombocytosis as Predictive Factors for Post-Operative Complications Following Laryngectomy

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Abstract

Objective: Abnormal platelet counts are associated with complications. The objective of this study is to determine association between thrombocytopenia, normal platelet count, and thrombocytosis with postoperative outcomes following laryngectomy.

Study Design: Retrospective database study.

Methods: The 2005-2018 National Surgical Quality Improvement Program (NSQIP) database was queried for all patients undergoing laryngectomy. Cases were grouped based on the following platelet values: Normal (150,000-450,000 μ L), Thrombocytopenia (\leq 150,000 μ L), Thrombocytosis (\geq 450,000 μ L). Univariate and multivariate analyses were performed to determine association of each group with postoperative outcomes.

Results: A total of 2,639 patients underwent laryngectomy, of which 991 patients (37.6%) experienced complications. 2,193 patients (83.1%) had valid preoperative platelet values and were labeled as thrombocytopenia (n=138, 6.29%), thrombocytosis (n=125, 5.70%), and normal (n=1930, 88.0%). Univariate analysis demonstrated significant associations between platelet count and postoperative complications. Patients with thrombocytosis had longer operative time (493.78 vs 413.70 min, p<0.01). Adjusting for confounding variables, multivariate regression analysis demonstrated significant association between thrombocytosis and any postoperative complication (OR: 1.874 (1.289-2.725), p=0.01). Specifically, thrombocytosis was significantly associated with bleeding transfusion (OR: 2.138 (1.441-3.172), p<0.01).

Conclusions: Our study indicates that patients with thrombocytosis are at risk of developing postoperative complications following laryngectomy, however thrombocytopenia has no association as an independent risk factor.

Introduction

- Following laryngectomy, persistent tracheoesophageal fistula is a common complication and quite difficult to treat. This can delay resumption of feeding and longer hospital length of stay. Recently, platelet-rich plasma injection has been studied to promote wound healing postoperatively.¹⁻³
- Platelets serve as important scaffolds for inflammatory cells to secrete cytokines and promote repair.⁴ The effect of preoperative platelet values in patients undergoing laryngectomy has not been researched to assess its effect on complications.
- In this study, we compared preoperative demographic and comorbidity variables between patients undergoing laryngectomy who had preoperative normal, elevated, or below normal platelet levels.

Methods

The National Surgical Quality Improvement Database (NSQIP) database was queried for patients undergoing laryngectomy between 2005 and 2018, using Current Procedural Terminology (CPT) codes. Three cohorts were formed based on preoperative platelet levels: Normal (150,000-450,000 μ L), Thrombocytopenia (\leq 150,000 μ L), Thrombocytosis (\geq 450,000 μ L). Demographics and preoperative comorbidities were analyzed using Pearson chi-squared and unpaired t-tests. Multivariate logistic regression analysis was performed using odds ratios (OR) to identify independent risk factors for postoperative complications.

References: Damien M, Leclercq C, Steffens Y, Dequanter D, Rodriguez A. Platelet-Rich Plasma, an Innovative and Noninvasive Technique for Closure of Tracheoesophageal Fistula After Laryngectomy, Report of 2 Cases. *Ear, Nose & Throat Journal*. 2022;0(0). doi:10.1177/01455613221124729. 2. Spartzis E, Athanasiou A, Spartzis M, Troupis T. Platelet-Rich Fibrin in Total Laryngectomy: Long-Term Safety Concerns. *Facial Plast Surg*. 2021;37(4):550. doi:10.1055/s-0041-1729636. 3. Everts PAM, Knape JTA, Welbrich G, et al. Platelet-rich plasma and platelet gel: a review. *J Extra Corpor Technol* 2006; 38 (02): 174-187. 4. Well IA, Kumar P, Seicean S, Neuhouser D, Seicean A. Platelet count abnormalities and peri-operative outcomes in adults undergoing elective, non-cardiac surgery. *PLoS One*. 2019;14(2):e0212191. Published 2019 Feb 11. doi:10.1371/journal.pone.0212191

Table 1. Chi Square Analysis of Patient Demographic, Comorbidities, and Complication

Patient and procedure characteristics	Total, N = 2639	Normal Platelet Count, (N = 1930)	Thrombocytopenia (N = 138)	Thrombocytosis (N = 125)	P-Value
Gender, n (%)					<0.01
Female	532 (20.2)	375 (19.4)	12 (8.70)	33 (26.4)	
Male	2107 (79.8)	1555 (80.6)	126 (91.3)	92 (73.6)	
Race, n (%)					1.00
White	1824 (69.1)	1309 (67.8)	107 (77.5)	77 (61.6)	
Black	376 (14.2)	279 (14.5)	19 (13.8)	27 (21.6)	
Hispanic	31 (1.20)	26 (1.30)	1 (0.70)	1 (0.80)	
Asian	45 (1.70)	32 (1.70)	0 (0.00)	3 (2.40)	
Other	27 (1.00)	20 (1.00)	1 (0.70)	2 (1.60)	
Comorbidities, n (%)					
Smoker within 1 year	1243 (47.1)	922 (47.8)	59 (42.8)	84 (67.2)	<0.01
Diabetes	367 (13.9)	275 (14.2)	23 (16.7)	10 (8.00)	0.098
Dyspnea	555 (21.0)	416 (21.6)	29 (21.0)	41 (32.8)	0.013
Ventilation Support	29 (1.10)	23 (1.20)	5 (3.60)	0 (0.00)	0.021
Hypertension	1273 (48.2)	932 (48.3)	68 (49.3)	58 (46.4)	0.891
Steroid	128 (4.90)	106 (5.50)	4 (2.90)	5 (4.00)	0.34
COPD ^c	469 (17.8)	351 (18.2)	23 (16.7)	32 (25.6)	0.1
CHF ^d	33 (1.30)	30 (1.60)	1 (0.70)	0 (0.00)	0.281
Weight Loss	351 (13.3)	257 (13.3)	12 (8.70)	37 (29.6)	<0.01
Bleeding Disorder	80 (3.00)	50 (2.60)	15 (10.9)	4 (3.20)	<0.01
Sepsis	77 (2.90)	61 (3.20)	5 (3.60)	10 (8.00)	0.016
Dialysis	16 (0.60)	11 (0.60)	2 (1.40)	0 (0.00)	0.289
Obesity	382 (14.5)	264 (13.7)	27 (19.6)	6 (4.80)	0.008
Complication, n (%)					
Superficial Incisional SSI ^a	173 (6.60)	117 (6.10)	13 (9.40)	11 (8.80)	0.161
Deep Incisional SSI ^a	114 (4.30)	75 (3.90)	7 (5.10)	8 (6.40)	0.327
Wound Disruption	130 (4.90)	96 (5.00)	3 (2.20)	12 (9.60)	0.02
Pneumonia	122 (4.60)	99 (5.10)	10 (7.20)	5 (4.00)	0.459
Unplanned Intubation	53 (2.00)	42 (2.20)	3 (2.20)	1 (0.80)	0.581
Pulmonary Embolism	10 (0.40)	8 (0.40)	0 (0.00)	0 (0.00)	0.579
Acute Renal Failure	2 (0.10)	1 (0.10)	1 (0.70)	0 (0.00)	0.038
Urinary Tract Infection	27 (1.00)	26 (1.30)	0 (0.00)	1 (0.80)	0.346
CVA ^b /Stroke	9 (0.30)	4 (0.20)	0 (0.00)	2 (1.60)	0.013
Myocardial Infarction	14 (0.50)	10 (0.50)	1 (0.70)	0 (0.00)	0.678
Bleeding Transfusion	504 (19.1)	365 (18.9)	27 (19.6)	46 (36.8)	<0.01
DVT ^e /Thrombophlebitis	47 (1.80)	41 (2.10)	1 (0.70)	1 (0.80)	0.326
C. Difficile Infection	19 (0.70)	11 (0.60)	2 (1.40)	3 (2.40)	0.039
Overall Complication	991 (37.6)	724 (37.5)	56 (40.6)	70 (56.0)	<0.01

Results

- A total of 2,639 patients underwent laryngectomy (79.8% male, 20.2% female). 138 patients had thrombocytopenia, 125 patients had thrombocytosis, and 1930 patients had a normal platelet count. Chi square analysis of demographic, comorbidity, and complication information are shown in **Table 1**.
- Multivariate logistic regression analysis, accounting for significant covariates, is shown in **Table 2, 3, & 4**.

Table 2. Multivariable Logistic Regression Analysis of Platelet Levels as Predictors of Complications

Platelet Lab Test Level	OR	95% CI	P-Value
<i>Multivariate analysis of Abnormal Lab Tests predicting Postoperative Complications</i>			
Normal Platelet	Reference	Reference	Reference
Thrombocytopenia	1.118	0.779 - 1.605	0.544
Thrombocytosis	1.85	1.272 - 2.690	0.001
<i>Multivariate analysis of Abnormal Lab Tests predicting Postoperative Stroke/CVA</i>			
Normal Platelet	Reference	Reference	Reference
Thrombocytopenia	0	0	0.996
Thrombocytosis	9.069	1.581 - 52.013	0.013
<i>Multivariate analysis of Abnormal Lab Tests predicting Bleeding Transfusion</i>			
Normal Platelet	Reference	Reference	Reference
Thrombocytopenia	1.974	0.685 - 1.683	0.755
Thrombocytosis	2.085	1.404 - 3.096	<0.01
<i>Multivariate analysis of Abnormal Lab Tests predicting C. Difficile Infection</i>			
Normal Platelet	Reference	Reference	Reference
Thrombocytopenia	2.641	0.562 - 12.403	0.218
Thrombocytosis	4.015	1.065 - 15.135	0.04

Table 3. Multivariable Logistic Regression Analysis of Platelet Levels as Predictors of Average Age

Platelet Lab Value	Average Age in Years, mean	P-Value	Platelet Lab Value	Average Age in Years, mean	P-Value
		0.767			0.004
Normal	63.02		Normal	63.02	
Below Normal	63.3		Above Normal	60.21	

Table 4. Multivariable Logistic Regression Analysis of Platelet Levels as Predictors of Length of Stay

Platelet Lab Value	Average Length of Stay (min)	P-Value	Platelet Lab Value	Average Length of Stay (min)	P-Value
		0.489			<0.01
Normal	413.7		Normal	413.7	
Below Normal	425.25		Above Normal	493.78	

Discussion and Conclusion

Our study found that although thrombocytosis and thrombocytopenia are associated with specific comorbidities and complications on chi square analysis, only thrombocytosis serves as an independent risk factor for complications overall, such as postoperative stroke, bleeding transfusion requirement, and C.Diff infection. Though studies show increased wound healing with postoperative platelet infusion, preoperative platelet reduction may be considered prior to laryngectomy.¹⁻³ We hope this will aid surgeons preparing for adverse outcomes due to preoperative platelet values.