

Risk for Post-Spinal Surgery Complications Associated with Pre-Operative Blood Transfusions

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Objective

The frequency of spinal surgeries has increased dramatically in the United States over the past decade and, as with all surgeries, spinal procedures carry inherent risks for complications after the operation. Recently, it has been recognized that procedures in which intra-operative/post-operative blood transfusions are administered carry a higher risk of postoperative morbidity and increased length of hospital stay. Despite this, there is little literature, currently, analyzing post-operative complications associated with blood transfusions taking place 72 hours prior to spinal operations. The aim of this study was to investigate the prevalence of pre-operative blood transfusions in spinal surgeries and elucidate the associations that exist between those transfusions and post-operative complications (Seisean *et al.*).

Methods

We retrospectively analyzed cases of spinal surgeries between 2005 and 2014 from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database with the exception of 2009 due to incomplete data. A total of 42,284 patients who had undergone spinal procedures were studied. Patients receiving pre-operative blood transfusions within 72 hours of surgery were documented. Demographic factors, including sex and age, were noted. Comorbidities included in this analysis include body mass index (BMI) and American Society of Anesthesiologists (ASA) score. Post-operative complications were stratified into major and minor categories. Chi-squared test, Fisher's exact test, and ANOVA were used to perform univariate testing where appropriate, while multivariate analyses were performed to determine independent risk factors for complications.

Results

Pre-Operative Comorbidities	No Blood Transfusion		Blood Transfusion		P-Value
	42061		223		
	N	%	N	%	
Cardiac	20858	49.6%	132	59.2%	0.005
Renal Failure	16	0.1%	2	0.9%	0.004
Dialysis	121	0.3%	9	4.0%	<0.001
Steroid use	1590	3.8%	937	16.6%	<0.001
Weight loss	139	3.8%	17	7.6%	<0.001
Pulmonary	1761	4.2%	20	9.0%	0.002
Bleeding Disorders	738	1.8%	20	9.0%	<0.001

Table 1: Pre-Operative Comorbidities of Patients Undergoing Spinal Procedures

Results

Demographics & Clinical Characteristics	No Blood Transfusion		Received Blood Transfusion		P-Value
	42061		223		
	N	%	N	%	
Sex					0.009
Female	20916	49.7%	131	58.7%	
Male	21145	50.3%	92	41.3%	
Race					0.131
White	35616	84.7%	191	85.7%	
Black or African American	3056	7.3%	11	4.9%	
Hispanic	2033	4.8%	8	3.6%	
American Indian or Alaska Native	116	0.3%	2	0.9%	
Asian	1044	2.5%	9	4.0%	
Native Hawaiian or Pacific Islander	196	0.5%	2	0.9%	
Anesthesia					0.959
General	41582	98.9%	220	98.7%	
MAC/IV Sedation	161	0.4%	1	0.4%	
Regional	318	0.8%	2	0.9%	
Diabetes					0.003
No DM	35731	85.0%	177	79.4%	
NIDDM	4232	10.1%	24	10.8%	
IDDM	2098	5.0%	22	9.9%	
ASA Score					<0.001
1 or 2	24688	58.7%	42	18.8%	
3 or 4	17373	41.3%	181	81.2%	
Smoke					0.414
Dyspnea					<0.001
No dyspnea	39599	94.1%	201	90.1%	
Moderate exertion	2349	5.6%	15	6.7%	
At rest	113	0.3%	7	3.1%	
Pre-Operative Functional Status					<0.001
Independent	40810	97.0%	176	78.9%	
Partially Dependent	1137	2.7%	40	17.9%	
Totally Dependent	114	0.3%	7	3.1%	

Table 2: Demographics & Clinical Characteristics of 42,284 Spinal Procedure Patients

Risk Factors	P-Value	Odds Ratio	95% Confidence Interval	
			Low	High
			Pre-Operative Blood Transfusion	<0.001
Female vs. Male	0.001	1.142	1.055	1.236
African American vs. White	<0.001	1.518	1.327	1.736
IDDM vs. No DM	<0.001	1.302	1.125	1.508
Dyspnea w/ Moderate Exertion vs No Dyspnea	<0.001	3.307	2.857	3.828
Dyspnea at Rest vs. No Dyspnea	<0.001	7.826	5.311	11.532
COPD vs. No COPD	0.01	1.227	1.049	1.435
HTN vs. No HTN	0.025	0.899	0.819	0.987
Dialysis vs. No Dialysis	<0.001	4.351	2.95	6.418
History of Steroid vs. No Steroid	0.018	1.218	1.035	1.433
Weight Loss vs. No Weight Loss	<0.001	5.159	3.559	7.478
Bleeding Disorder vs. No Bleeding Disorder	<0.001	1.918	1.576	2.335
Age	<0.001	1.013	1.009	1.016
BMI	<0.001	0.987	0.981	0.994

Table 3: Multivariate Analysis of Blood Transfusion as an Independent Risk Factor for Extended Length of Hospital Stay (>7 days)

Post-Operative Complication	P-Value	Odds Ratio	95% Confidence Interval	
			Low	High
Deep wound infection	0.009	2.862	1.303	6.287
Organ/Space Infection	0.009	3.882	1.41	0.691
Wound Dehiscence	0.028	4.131	1.162	14.682
Pneumonia	<0.001	3.653	2.125	6.281
Reintubation	0.115	1.882	0.858	4.13
Failure to Wean (>48 hours)	<0.001	7.876	5.012	12.375
Renal Insufficiency	0.032	4.333	1.139	16.485
Urinary Tract Infection	0.185	1.581	0.804	3.11
Stroke	0.069	3.459	0.909	13.169
Cardiac Arrest	0.737	1.297	0.283	5.941
DVT	0.325	1.609	0.624	4.15
Systemic Sepsis	0.003	2.702	1.408	5.186
Septic Shock	0.01	3.179	1.318	7.669
Death	0.002	3.211	1.535	6.718

Table 4: Multivariate Analysis to Determine if Pre-Operative Blood Transfusion is an Independent Risk Factor for Post-Operative Complications after Spinal Procedures

Risk Factors	P-Value	Odds Ratio	95% Confidence Interval	
			Low	High
Pre-Operative Blood Transfusion	0.022	1.784	1.086	2.929
Age>80 vs. Age≤50	0.027	1.333	1.034	1.718
Dyspnea at Moderate Exertion vs. No Dyspnea	0.033	1.253	1.018	1.542
Partially Dependent vs. Independent Functional Status	<0.001	1.806	1.418	2.301
Totally Dependent vs. Independent Functional Status	0.038	2.026	1.042	3.942
Dialysis vs. No Dialysis	0.014	2.127	1.165	3.886
Weight Loss vs. No Weight Loss	0.001	2.527	1.470	4.344
ASA Score 3-4 vs. ASA Score 1-2	<0.001	1.780	1.557	2.034
Obese III vs. Non-Obese	0.013	1.296	1.057	1.589

Table 5: Multivariate Analysis for Blood Transfusion as an Independent risk factor for Return to Operating Room

Conclusions

Overall, patients receiving blood transfusions within 72 hours prior to undergoing spinal procedures had increased rates of several post-operative complications. Among these complications, the most notable include superficial and deep wound infections, wound dehiscence, pneumonia, systemic sepsis, septic shock, stroke, and even death.

Armed with this knowledge, surgeons would better be able to predict, and therefore mitigate, such post-operative complications in these patients. Future research in this area, directed toward stratification of risk based on the patient's need for pre-operative blood transfusion and procedure type, would provide further insight into preventing post-operative complications after spinal surgeries.

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