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Independent Predictors of In-Hospital Mortality in Patients Undergoing Emergency Admission for Arterial Embolism and Thrombosis in the USA: A 10-Year National Dataset

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Abstract

Background: Arterial embolism and thrombosis were estimated to account for 25% of deaths globally in 2010 and are the leading cause of mortality. As a global shift of morbidity and mortality from infectious diseases to non-infectious causes, cardiovascular diseases became the leading cause of death.

Objective: The goal of this study was to evaluate independent predictors of in-hospital mortality in non-elderly adult and elderly patients undergoing emergency admission for complicated arterial embolism and thrombosis.

Methods: Demographic and clinical data were obtained from the National Inpatient Sample (NIS), 2005-2014, to evaluate non-elderly adult patients (age 18-64 years) and elderly patients (65+ years) with arterial embolism and thrombosis who underwent emergency admission. Multivariable logistic regression models were used to identify association of predictors and in-hospital mortality.

Results: A total of 1,041 non-elderly adult patients and 1,260 elderly patients were included in the study, of which 40.1% and 49.0% were females, respectively. Their mean (SD) age was 55 (7) years and 75 (7) years, respectively. Overall mortality was 0.9% in the adult patients and 2.0% in the elderly patients, of which 44.4% and 68.0% were females, respectively. Backward multivariable logistic regression analysis demonstrated risk factors of mortality in operated patients: delayed operation and frailty index for adults, and female sex and frailty index for elderly.

Conclusion: In operated patients, the main risk factors of mortality were delayed operation and frailty index for adults, and female sex and frailty index for elderly.

Key Words: Arterial embolism and thrombosis, in-hospital mortality, hospital length of stay.

Introduction

Thromboembolism is a term referring to large clots that dislodge from the surface of atherosclerotic lesions and occlude distal arteries causing immediate ischemia. Atrial thrombosis, the obstruction of blood flow due to the formation of clot, may result in tissue anoxia and damage. Arterial embolism results when a mass of tissue or a foreign substance travel through the vascular tree, to eventually lodge in a distal artery where it blocks blood flow. This obstruction results in ischemia, organ dysfunction and potential infarction. The most common manifestations are strokes and acute lower limb ischemia. Complications of arterial embolism and thrombosis are a chief cause of dysfunction and death in the United States[1]. Global Burden of Diseases 2010 clearly documents the major impact of arterial thrombosis on global disease burden

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because it is the pathological mechanism underlying most cases of ischemic heart disease and ischemic stroke. Early diagnosis and timely surgical intervention are the cornerstones of modern treatment and are essential to reduce the high mortality associated with this entity. However, surgical and intensive care patients are at an enhanced risk for arterial embolization due to pre-existing conditions such as hypertension, cardiovascular abnormalities, electrolyte disorders and atherosclerotic disease. Unlike myocardial infarction and stroke associated mortality, insufficient research has focused on optimizing care management of patients with arterial emboli and thrombosis to reduce morbidity and mortality. Signs of the shifting outlook for acute pulmonary embolism care can be seen in the expeditious promulgation of the pulmonary embolism response team (PERT) concept and the adoption of novel strategies to treat acute pulmonary embolism with endovascular technologies. Risk factors for adverse outcomes following emergency surgery for arterial emboli and thrombosis complications are still debated. Some factors were repeatedly found to be the predictors of mortality including but not limited to emergency surgery, age, and patient health status. Nonetheless, the prognostic value of emergency surgery status was challenged with regards to arterial emboli and thrombosis surgical outcome. The aim of this study was to evaluate the predictors of in-hospital mortality following emergency admission for arterial emboli and thrombosis to help identify ways to improve the field and achieve better patient outcomes.

Methods

The Healthcare Cost and Utilization Project (HCUP) was established to provide multistate, administrative, population-based data on patients in a uniform format. The data are designed for health services research to enhance health care provision. The National Inpatient Sample (NIS), a large administrative database produced by the Agency for Healthcare Research and Quality (AHRQ), has been progressively used as a country-wide publicly data source, holding much potential and support the assessment of patterns of care and outcomes for research. It allows novel approaches to investigate disease conditions, optimal care, and patient outcomes. The NIS is a stratified weighted sample of discharges from US community hospitals, excluding rehabilitation and long-term acute care facilities. The significance of the weighting is for allowing to produce national estimates of hospitalizations for specific factors, however national estimates were not the focus of this project. This retrospective cohort study extracted data on adult and elderly patients with arterial embolism and thrombosis that had emergency admissions.

The sample extracted from the NIS-2005-2014. The ICD-9 code to identify patients with, was 444. ICD-9 codes for surgical procedures and invasive diagnostic procedures data are presented in Table 1. The following characteristics of patients and hospitals were collected: age, gender, race, income quartile, health care insurance (Medicare, Medicaid, private insurance, self-paid, and no charge), hospital length of stay (HLOS), mortality rate, location of embolism, total charges and the modified frailty index.

Table 1: Procedures of emergency admitted patients with the primary diagnosis of arterial embolism and thrombosis.

Cardiovascular System Surgical Procedures (ICD 9)
Operations on Valves and Septa of Heart (35.00-35.99)
Operations on Vessels of Heart (36.03-36.99)
Operations on Heart and Pericardium (37.0-37.12, 37.31-37.99)
Operations on Operations of Vessels (38.00-38.18, 38.30-39.99)
Cardiovascular System Invasive Diagnostic Procedure (ICD 9)
Invasive Diagnostic Procedure on Heart and Pericardium (37.20-37.29)
Invasive Diagnostic Procedure on Incision, Excision, and Occlusion of Vessels (38.21-38.29)

A frailty score was calculated using a 5-item modified frailty index. Comorbid diabetes was considered if either 1) comorbidity of diabetes uncomplicated or 2) diabetes with chronic complications was indicated. A past medical history of hypertension, congestive heart failure and chronic obstructive pulmonary disease were included if among the comorbidities. As the functional health status was unavailable in this particular dataset, we instead estimated based on the available variables. Comorbidities including tumor, renal failure, metastatic cancer, paralysis, lymphoma, coagulopathy, or weight loss, were considered partially or totally functionally dependent. Both of these criteria add 1 point to each item if the comorbidity item was present. This total is our estimated modified frailty score. This frailty score ranged from 0 to 5, 0 being not frail and 5 being really frail.

Statistical Analysis

Descriptive and analytical statistical indicators were used to present the findings. Mean, standard deviation (SD), and confidence interval at 95% (CI) were calculated for numerical variables. The comparisons were done by 2 test for categorical variables, and by t-test for continuous variables. The data were first stratified according to elderly vs. nonelderly adults and then, further stratified by male vs. female, survived vs. deceased and operated vs. not operated. The univariable behavior of different variables in predicting the mortality risk was evaluated by logistic regression analysis. Multivariable logistic regression model was used to find the final predictors of mortality in adjusted model through backward stepwise regression analysis. Multivariable regression was adjusted for the following characteristics of patients and hospitals: age, sex, race, income quartile, health care insurance, hospital location, modified frailty index, location of embolism, invasive diagnostic procedures, and time to operation. The basic residual plots were checked to assure good compliance with model assumptions. The p values less than 0.05 were considered significant. All analyses were done by SPSS software version 26 (SPSS Inc., Chicago, IL).

Results

Sex Differences

Non-elderly patients

The mean age of the nine patients who died during the study period was 58 (7) years, 5 were males (55.6%) and 4 were females (44.4%), with a similar mean age. Regardless of the gender, most patients were white, funded by private insurance, and were admitted to urban teaching hospitals. Some of the major comorbidities were chronic pulmonary disease and peripheral vascular disorders, among others. Men were more at risk for alcohol abuse and peripheral vascular disorders whereas women were at a higher risk for deficiency anemia, chronic pulmonary disease and obesity. Women were also more likely ot have a longer HLOS. Patient characteristics are summarized in Table 2.

Elderly Patients

The mean age of the 25 patients who died during the study period was 80 (8) years, 8 were males (32.0%) and 17 were females (68.0%), with a similar mean age. Regardless of the gender, most patients were white, funded by Medicare, and were admitted to urban non-teaching hospitals. Men were more likely to suffer from alcohol abuse and uncomplicated diabetes. Women on the other hand were more at risk for hypothyroidism and a longer HLOS.

Mortality

Non-Elderly

0.9% of adult patients died in hospital with a similar demographics and clinical characteristics to those who survived. Coagulopathy and renal failure were the only comorbidities that were more prevalent in deceased compared to survived ones.

Elderly

In elderly patients, 2% died in the hospital. They were four years older than the survived patients (79.56 vs. 75.43 years old) and their time to operation was more than double of those who survived (0.45 vs 1.00 days). The prevalence of comorbidities of coagulopathy, renal failure, liver diseases, weight loss and fluid/electrolyte disorders were significantly higher in deceased vs. survived patients (Table 3).

Operation vs. No Operation

Non-Elderly

The stratified analysis based on operation is presented in Table 4. In adult patients, most clinical and demographic characteristics were similar. Congestive heart failure, valvular diseases and hypothyroidism were significantly more common in non-operated adults than the operated adults which may partly explain why they were not operated on. The operated-on group also was two years younger on average (55 vs 53 years old) and had a longer HLOS by one day (5 vs. 4). In this patient group, all the invasive diagnostic procedure were conducted on the heart and pericardium which comprised ICD-9 codes 37.20-37.29. 99.5% of the surgical operations were on vessels (ICD-9 codes 38.00-38.18, 38.30-39.99).

Elderly

Patients were mostly white and at an urban teaching hospital. In elderly patients the rate of comorbidities of congestive heart failure, valvular diseases and solid tumors were significantly more common in non-operated patients than the operated ones which may partly explain why they were not operated. The comorbidities most common in patients that underwent a surgery were chronic pulmonary disease, peripheral vascular disease and hypertension (Table 4). In the elderly patient group, 95.2% of the invasive diagnostic procedures were performed on the heart and pericardium which comprised ICD-9 codes 37.20-37.29. The surgical operations on vessels in this patient group was 98.2%.

Location of Arterial Thromboembolism

Non-Elderly

The stratified analysis based on location of arterial embolism and thrombosis in adult patients is presented in Table 5. More than half of the thromboembolisms/thromboses were located in the lower extremities, followed by abdomen, iliac arteries, upper extremities and thoracic. Patients with a lower extremity thrombosis or thromboembolism were most likely to suffer from uncomplicated diabetes compared to other locations. Those with abdominal clots had the highest likelihood of having a peripheral vascular disease relative to the other places. The modified frailty index was highest for patients with a thoracic clot. The time to surgery was the longest for upper extremity clot patients. The highest mean HLOS was recorded among patients with abdominal arterial thromboembolism followed by upper extremities, and lower extremities.

Elderly

Two-thirds of arterial thromboembolism were found in lower extremities followed by iliac arteries, and abdomen. In those with abdominal clots, chronic pulmonary disease, coagulopathy, peripheral vascular disease and fluid/electrolyte disorders were more likely. Obesity was most common in iliac clot patients. The mean HLOS was highest in patients with abdominal arterial thromboembolism followed by lower and upper extremities (Table 6).

Risk Factors of Mortality

The multivariable logistic regression model for mortality was built for the group with operation. Common variables used to adjust the two models were age, sex, race, income, health care insurance, hospital location, embolism/thrombosis location, invasive diagnostic procedure, modified frailty index and time to operation. In operated patients, the main risk factors of mortality in the final multivariable model were delayed operation and frailty index for adults, and female sex and frailty index for elderly patients (Table 7).

Table 2. Characteristics of emergency admitted patients with the primary diagnosis of arterial embolism and thrombosis. Data was stratified according to sex categories, NIS 2004-2014.

Patients' Characteristics		Adult, N (%)			Elderly, N (%)		
		Male	Female	p	Male	Female	p
All Cases		624 (59.9%)	417 (40.1%)		642 (51.0%)	618 (49.0%)	
Race	White	356 (75.4%)	234 (76.2%)	0.260	414 (80.9%)	371 (79.4%)	0.920
	Black	67 (14.2%)	51 (16.6%)		41 (8.0%)	46 (9.9%)	
	Hispanic	31 (6.6%)	18 (5.9%)		36 (7.0%)	29 (6.2%)	
	Asian/Pacific Islander	4 (0.8%)	2 (0.7%)		4 (0.8%)	5 (1.1%)	
	Native American	2 (0.4%)	1 (0.3%)		3 (0.6%)	3 (0.6%)	
	Other	12 (2.5%)	1 (0.3%)		14 (2.7%)	13 (2.8%)	
Income Quartile	Quartile 1	196 (32.7%)	145 (35.7%)	0.490	188 (29.7%)	184 (30.6%)	0.930
	Quartile 2	166 (27.7%)	120 (29.6%)		175 (27.6%)	163 (27.1%)	
	Quartile 3	132 (22.0%)	78 (19.2%)		138 (21.8%)	136 (22.6%)	
	Quartile 4	105 (17.5%)	63 (15.5%)		133 (21.0%)	119 (19.8%)	
Insurance	Private Insurance	374 (60.0%)	222 (53.8%)	**0.007**	64 (10.0%)	44 (7.1%)	0.180
	Medicare	131 (21.0%)	102 (24.7%)		565 (88.3%)	561 (90.8%)	
	Medicaid	57 (9.1%)	64 (15.5%)		3 (0.5%)	8 (1.3%)	
	Self-Pay	28 (4.5%)	12 (2.9%)		3 (0.5%)	2 (0.3%)	
	No Charge	2 (0.3%)	1 (0.2%)		0 (0%)	0 (0%)	
	Other	31 (5.0%)	12 (2.9%)		5 (0.8%)	3 (0.5%)	
Hospital Location	Rural	66 (10.6%)	55 (13.2%)	0.440	68 (10.6%)	78 (12.6%)	0.180
	Urban: Non-Teaching	271 (43.4%)	175 (42.0%)		314 (48.9%)	271 (43.9%)	
	Urban: Teaching	287 (46.0%)	187 (44.8%)		260 (40.5%)	268 (43.4%)	
Comorbidities	AIDS	1 (0.2%)	1 (0.2%)	0.999	0 (0%)	1 (0.2%)	0.490
	Alcohol Abuse	23 (3.7%)	6 (1.4%)	**0.034**	14 (2.2%)	3 (0.5%)	**0.012**
	Deficiency Anemias	46 (7.4%)	50 (12.0%)	**0.012**	77 (12.0%)	73 (11.8%)	0.920
	Rheumatoid Arthritis	8 (1.3%)	12 (2.9%)	0.070	9 (1.4%)	16 (2.6%)	0.130
	Chronic Blood Loss	4 (0.6%)	4 (1.0%)	0.720	7 (1.1%)	10 (1.6%)	0.420
	Congestive Heart Failure	9 (1.4%)	3 (0.7%)	0.380	13 (2.0%)	24 (3.9%)	0.051
	Chronic Pulmonary Disease	149 (23.9%)	127 (30.5%)	**0.018**	168 (26.2%)	169 (27.3%)	0.640
	Coagulopathy	10 (1.6%)	14 (3.4%)	0.070	18 (2.8%)	19 (3.1%)	0.780
	Depression	22 (3.5%)	30 (7.2%)	**0.008**	19 (3.0%)	25 (4.0%)	0.290
	Diabetes, Uncomplicated	133 (21.3%)	77 (18.5%)	0.260	197 (30.7%)	134 (21.7%)	**<0.001**
	Diabetes, Chronic Complications	28 (4.5%)	28 (6.7%)	0.120	42 (6.5%)	35 (5.7%)	0.520
	Drug Abuse	7 (1.1%)	5 (1.2%)	0.910	1 (0.2%)	0 (0%)	0.999
	Hypertension	373 (59.8%)	258 (61.9%)	0.500	442 (68.8%)	449 (72.7%)	0.140
	Hypothyroidism	12 (1.9%)	35 (8.4%)	**<0.001**	30 (4.7%)	85 (13.8%)	**<0.001**
	Liver Disease	13 (2.1%)	3 (0.7%)	0.120	4 (0.6%)	4 (0.6%)	0.999
	Lymphoma	4 (0.6%)	1 (0.2%)	0.650	3 (0.5%)	3 (0.5%)	0.999
	Fluid/Electrolyte Disorders	41 (6.6%)	46 (11.0%)	**0.011**	46 (7.2%)	71 (11.5%)	**0.008**
	Metastatic Cancer	6 (1.0%)	5 (1.2%)	0.710	13 (2.0%)	6 (1.0%)	0.130
	Other Neurological Disorders	21 (3.4%)	13 (3.1%)	0.830	13 (2.0%)	27 (4.4%)	**0.018**
	Obesity	35 (5.6%)	46 (11.0%)	**0.001**	19 (3.0%)	22 (3.6%)	0.550
	Paralysis	7 (1.1%)	4 (1.0%)	0.999	13 (2.0%)	8 (1.3%)	0.380
	Peripheral Vascular Disorders	340 (54.5%)	195 (46.8%)	**0.015**	285 (44.4%)	307 (49.7%)	0.060
	Psychoses	7 (1.1%)	7 (1.7%)	0.450	3 (0.5%)	8 (1.3%)	0.140
	Pulmonary Circulation Disorders	0 (0%)	1 (0.2%)	0.400	0 (0%)	3 (0.5%)	0.120
	Renal Failure	40 (6.4%)	28 (6.7%)	0.850	84 (13.1%)	74 (12.0%)	0.550
	Solid Tumor	6 (1.0%)	7 (1.7%)	0.310	15 (2.3%)	10 (1.6%)	0.360
	Peptic Ulcer	0 (0%)	0 (0%)		0 (0%)	0 (0%)	
	Valvular Disease	4 (0.6%)	5 (1.2%)	0.500	9 (1.4%)	7 (1.1%)	0.670
	Weight Loss	7 (1.1%)	7 (1.7%)	0.450	10 (1.6%)	17 (2.8%)	0.140
Embolism/ Thrombosis Location	Abdominal Aorta	128 (20.5%)	118 (28.3%)	**0.005**	60 (9.3%)	93 (15.0%)	**<0.001**
	Thoracic Aorta	0 (0%)	2 (0.5%)		2 (0.3%)	0 (0%)	
	Upper Extremity	43 (6.9%)	36 (8.6%)		25 (3.9%)	45 (7.3%)	
	Lower Extremity	345 (55.3%)	191 (45.8%)		444 (69.2%)	406 (65.7%)	
	Iliac Artery	108 (17.3%)	70 (16.8%)		111 (17.3%)	74 (12.0%)	
Invasive Diagnostic Procedure		16 (2.6%)	6 (1.4%)	0.220	12 (1.9%)	9 (1.5%)	0.570
Surgical Procedure		571 (91.5%)	382 (91.6%)	0.960	578 (90.0%)	532 (86.1%)	**0.031**
Deceased		5 (0.8%)	4 (1.0%)	0.999	8 (1.2%)	17 (2.8%)	0.060
		Mean (SD)	Mean (SD)	p	Mean (SD)	Mean (SD)	p
Age, Years		54.79 (6.85)	54.26 (8.02)	0.910	74.34 (6.66)	76.73 (7.69)	**<0.001**
Time to Invasive Diagnostic Procedure, Days		1.29 (1.68)	0.75 (1.50)	0.570	2.56 (3.81)	0.33 (0.52)	0.330
Time to Surgical Procedure, Days		0.38 (1.25)	0.55 (1.63)	0.490	0.48 (2.43)	0.44 (1.23)	0.180
Modified Frailty Index Score		1.23 (0.96)	1.32 (0.89)	0.120	1.56 (0.94)	1.51 (0.94)	0.350
Hospital Length of Stay, Days		4.27 (4.18)	5.16 (5.43)	**0.002**	4.67 (6.00)	5.16 (5.97)	**0.006**
Total Charges, Dollars		47,068 (46,633)	48,702 (42,588)	0.440	48,081 (46,000)	51,351 (54,678)	0.540

Table 3. Characteristics of emergency admitted patients with the primary diagnosis of arterial embolism and thrombosis. Data was classified according to outcome categories, NIS 2004-2014

Patients' Characteristics		Adult, N (%)		p	Elderly, N (%)		p
		Survived	Deceased		Survived	Deceased	
All Cases		1,033 (99.1%)	9 (0.9%)		1,235 (98.0%)	25 (2.0%)	
Sex, Female		413 (40.1%)	4 (44.4%)	0.999	601 (48.7%)	17 (68.0%)	0.060
Race	White	584 (75.7%)	5 (71.4%)	0.910	771 (80.3%)	14 (73.7%)	0.120
	Black	116 (15.0%)	2 (28.6%)		84 (8.8%)	3 (15.8%)	
	Hispanic	49 (6.4%)	0 (0%)		64 (6.7%)	1 (5.3%)	
	Asian/Pacific Islander	6 (0.8%)	0 (0%)		9 (0.9%)	0 (0%)	
	Native American	3 (0.4%)	0 (0%)		5 (0.5%)	1 (5.3%)	
	Other	13 (1.7%)	0 (0%)		27 (2.8%)	0 (0%)	
Income Quartile	Quartile 1	340 (34.1%)	1 (11.1%)	0.250	361 (29.8%)	11 (44.0%)	0.100
	Quartile 2	284 (28.5%)	2 (22.2%)		329 (27.2%)	9 (36.0%)	
	Quartile 3	206 (20.6%)	4 (44.4%)		273 (22.5%)	1 (4.0%)	
	Quartile 4	168 (16.8%)	2 (22.2%)		248 (20.5%)	4 (16.0%)	
Insurance	Private Insurance	593 (57.7%)	5 (55.6%)	0.580	105 (8.5%)	3 (12.0%)	0.930
	Medicare	229 (22.3%)	4 (44.4%)		1,104 (89.5%)	22 (88.0%)	
	Medicaid	120 (11.7%)	0 (0%)		11 (0.9%)	0 (0%)	
	Self-Pay	40 (3.9%)	0 (0%)		5 (0.4%)	0 (0%)	
	No Charge	3 (0.3%)	0 (0%)		0 (0%)	0 (0%)	
	Other	43 (4.2%)	0 (0%)		8 (0.6%)	0 (0%)	
Hospital Location	Rural	120 (11.6%)	1 (11.1%)	0.320	146 (11.8%)	0 (0%)	0.180
	Urban: Non-Teaching	442 (42.8%)	6 (66.7%)		571 (46.3%)	14 (56.0%)	
	Urban: Teaching	471 (45.6%)	2 (22.2%)		517 (41.9%)	11 (44.0%)	
Comorbidities	AIDS	2 (0.2%)	0 (0%)	0.999	1 (0.1%)	0 (0%)	0.999
	Alcohol Abuse	29 (2.8%)	0 (0%)	0.999	16 (1.3%)	1 (4.0%)	0.290
	Deficiency Anemias	94 (9.1%)	2 (22.2%)	0.200	146 (11.8%)	4 (16.0%)	0.530
	Rheumatoid Arthritis	20 (1.9%)	0 (0%)	0.999	25 (2.0%)	0 (0%)	0.999
	Chronic Blood Loss	8 (0.8%)	0 (0%)	0.999	15 (1.2%)	2 (8.0%)	**0.043**
	Congestive Heart Failure	11 (1.1%)	1 (11.1%)	0.100	35 (2.8%)	2 (8.0%)	0.170
	Chronic Pulmonary Disease	272 (26.3%)	3 (33.3%)	0.710	327 (26.5%)	10 (40.0%)	0.130
	Coagulopathy	22 (2.1%)	2 (22.2%)	**0.017**	32 (2.6%)	5 (20.0%)	**<0.001**
	Depression	52 (5.0%)	0 (0%)	0.999	44 (3.6%)	0 (0%)	0.999
	Diabetes, Uncomplicated	208 (20.1%)	2 (22.2%)	0.999	327 (26.5%)	4 (16.0%)	0.360
	Diabetes, Chronic Complications	56 (5.4%)	0 (0%)	0.999	75 (6.1%)	2 (8.0%)	0.660
	Drug Abuse	12 (1.2%)	0 (0%)	0.999	1 (0.1%)	0 (0%)	0.999
	Hypertension	626 (60.6%)	4 (44.4%)	0.330	877 (71.0%)	14 (56.0%)	0.100
	Hypothyroidism	46 (4.5%)	1 (11.1%)	0.340	113 (9.1%)	2 (8.0%)	0.999
	Liver Disease	15 (1.5%)	1 (11.1%)	0.130	6 (0.5%)	2 (8.0%)	**0.010**
	Lymphoma	5 (0.5%)	0 (0%)	0.999	6 (0.5%)	0 (0%)	0.999
	Fluid/Electrolyte Disorders	85 (8.2%)	2 (22.2%)	0.170	108 (8.7%)	9 (36.0%)	**<0.001**
	Metastatic Cancer	11 (1.1%)	0 (0%)	0.999	19 (1.5%)	0 (0%)	0.999
	Other Neurological Disorders	34 (3.3%)	0 (0%)	0.999	38 (3.1%)	2 (8.0%)	0.190
	Obesity	81 (7.8%)	0 (0%)	0.999	41 (3.3%)	0 (0%)	0.999
	Paralysis	11 (1.1%)	0 (0%)	0.999	21 (1.7%)	0 (0%)	0.999
	Peripheral Vascular Disorders	529 (51.2%)	6 (66.7%)	0.510	580 (47.0%)	12 (48.0%)	0.920
	Psychoses	14 (1.4%)	0 (0%)	0.999	11 (0.9%)	0 (0%)	0.999
	Pulmonary Circulation Disorders	1 (0.1%)	0 (0%)	0.999	3 (0.2%)	0 (0%)	0.999
	Renal Failure	65 (6.3%)	3 (33.3%)	**0.017**	151 (12.2%)	7 (28.0%)	**0.018**
	Solid Tumor	13 (1.3%)	0 (0%)	0.999	24 (1.9%)	1 (4.0%)	0.400
	Peptic Ulcer	0 (0%)	0 (0%)		0 (0%)	0 (0%)	
	Valvular Disease	8 (0.8%)	1 (11.1%)	0.080	15 (1.2%)	1 (4.0%)	0.280
	Weight Loss	14 (1.4%)	0 (0%)	0.999	23 (1.9%)	4 (16.0%)	**0.002**
Embolism/ Thrombosis Location	Abdominal Aorta	242 (23.4%)	4 (44.4%)	0.260	146 (11.8%)	7 (28.0%)	0.160
	Thoracic Aorta	2 (0.2%)	0 (0%)		2 (02%)	0 (0%)	
	Upper Extremity	79 (7.6%)	0 (0%)		68 (5.5%)	2 (8.0%)	
	Lower Extremity	534 (51.7%)	2 (22.2%)		837 (67.8%)	13 (52.0%)	
	Iliac Artery	176 (17.0%)	3 (33.3%)		182 (14.7%)	3 (12.0%)	
Invasive Diagnostic Procedure		22 (2.1%)	0 (0%)	0.999	18 (1.5%)	3 (12.0%)	**0.007**
Surgical Procedure		945 (91.5%)	9 (100%)	0.999	1,089 (88.2%)	21 (84.0%)	0.530
		Mean (SD)	Mean (SD)	p	Mean (SD)	Mean (SD)	p
Age, Years		54.53 (7.36)	57.67 (4.72)	0.230	75.43 (7.24)	79.56 (8.36)	**0.014**
Time to Invasive Diagnostic Procedure, Days		1.17 (1.62)	-(-)		1.58 (3.18)	2.00 (3.46)	0.950
Time to Surgical Procedure, Days		0.45 (1.42)	0.63 (0.92)	0.130	0.45 (1.97)	1.00 (1.48)	**0.002**
Modified Frailty Index Score		1.26 (0.93)	1.67 (1.00)	0.200	1.53 (0.94)	1.88 (1.05)	0.070
Hospital Length of Stay, Days		4.63 (4.75)	3.44 (3.58)	0.270	4.88 (5.96)	6.28 (7.10)	0.700
Total Charges, Dollars		47,481 (45,066)	74,895 (28,306)	**0.003**	48,706 (48,244)	99,400 (107,564)	**0.021**

Table 4. Characteristics of emergency admitted patients with the primary diagnosis of arterial embolism and thrombosis. Data was stratified according to operation status, NIS 2004-2014.

Patients' Characteristics		Adult, N (%)		p	Elderly, N (%)		p
		No Operation	Operation		No Operation	Operation	
All Cases		88 (8.4%)	955 (91.6%)		150 (11.9%)	1,110 (88.1%)	
Sex, Female		35 (39.8%)	382 (40.1%)	0.999	86 (57.3%)	532 (47.9%)	**0.031**
Race	White	50 (79.4%)	540 (75.4%)	0.590	84 (75.7%)	701 (80.8%)	**0.048**
	Black	8 (12.7%)	110 (15.4%)		6 (5.4%)	81 (9.3%)	
	Hispanic	3 (4.8%)	46 (6.4%)		11 (9.9%)	54 (6.2%)	
	Asian/Pacific Islander	0 (0%)	6 (0.8%)		2 (1.8%)	7 (0.8%)	
	Native American	1 (1.6%)	2 (0.3%)		2 (1.8%)	4 (0.5%)	
	Other	1 (1.6%)	12 (1.7%)		6 (5.4%)	21 (2.4%)	
Income Quartile	Quartile 1	22 (26.5%)	319 (34.5%)	0.280	53 (36.3%)	319 (29.3%)	0.200
	Quartile 2	30 (36.1%)	256 (27.7%)		42 (28.8%)	296 (27.2%)	
	Quartile 3	19 (22.9%)	191 (20.7%)		28 (19.2%)	246 (22.6%)	
	Quartile 4	12 (14.5%)	158 (17.1%)		23 (15.8%)	229 (21.0%)	
Insurance	Private Insurance	50 (58.1%)	548 (57.6%)	0.170	9 (6.0%)	99 (8.9%)	0.770
	Medicare	21 (24.4%)	212 (22.3%)		137 (91.9%)	989 (89.2%)	
	Medicaid	5 (5.8%)	116 (12.2%)		1 (0.7%)	10 (0.9%)	
	Self-Pay	7 (8.1%)	33 (3.5%)		1 (0.7%)	4 (0.4%)	
	No Charge	0 (0%)	3 (0.3%)		0 (0%)	0 (0%)	
	Other	3 (3.5%)	40 (4.2%)		1 (0.7%)	7 (0.6%)	
Hospital Location	Rural	9 (10.2%)	112 (11.7%)	0.270	31 (20.8%)	115 (10.4%)	**<0.001**
	Urban: Non-Teaching	45 (51.1%)	403 (42.2%)		51 (34.2%)	534 (48.1%)	
	Urban: Teaching	34 (38.6%)	440 (46.1%)		67 (45.0%)	461 (41.5%)	
Comorbidities	AIDS	0 (0%)	2 (0.2%)	0.999	0 (0%)	1 (0.1%)	0.999
	Alcohol Abuse	1 (1.1%)	28 (2.9%)	0.500	0 (0%)	17 (1.5%)	0.250
	Deficiency Anemias	11 (12.5%)	85 (8.9%)	0.260	15 (10.0%)	135 (12.2%)	0.440
	Rheumatoid Arthritis	3 (3.4%)	17 (1.8%)	0.230	7 (4.7%)	18 (1.6%)	**0.012**
	Chronic Blood Loss	0 (0%)	8 (0.8%)	0.999	3 (2.0%)	14 (1.3%)	0.440
	Congestive Heart Failure	8 (9.1%)	4 (0.4%)	**<0.001**	26 (17.3%)	11 (1.0%)	**<0.001**
	Chronic Pulmonary Disease	14 (15.9%)	262 (27.4%)	**0.019**	28 (18.7%)	309 (27.8%)	**0.017**
	Coagulopathy	3 (3.4%)	21 (2.2%)	0.450	1 (0.7%)	36 (3.2%)	0.120
	Depression	5 (5.7%)	47 (4.9%)	0.750	7 (4.7%)	37 (3.3%)	0.400
	Diabetes, Uncomplicated	18 (20.5%)	192 (20.1%)	0.940	33 (22.0%)	298 (26.8%)	0.210
	Diabetes, Chronic Complications	5 (5.7%)	51 (5.3%)	0.890	11 (7.3%)	66 (5.9%)	0.510
	Drug Abuse	2 (2.3%)	10 (1.0%)	0.270	0 (0%)	1 (0.1%)	0.999
	Hypertension	51 (58.0%)	580 (60.7%)	0.610	86 (57.3%)	805 (72.5%)	**<0.001**
	Hypothyroidism	8 (9.1%)	39 (4.1%)	**0.030**	14 (9.3%)	101 (9.1%)	0.930
	Liver Disease	2 (2.3%)	14 (1.5%)	0.640	1 (0.7%)	7 (0.6%)	0.999
	Lymphoma	0 (0%)	5 (0.5%)	0.999	1 (0.7%)	5 (0.5%)	0.530
	Fluid/Electrolyte Disorders	8 (9.1%)	79 (8.3%)	0.790	9 (6.0%)	108 (9.7%)	0.140
	Metastatic Cancer	2 (2.3%)	9 (0.9%)	0.240	5 (3.3%)	14 (1.3%)	0.051
	Other Neurological Disorders	5 (5.7%)	29 (3.0%)	0.200	3 (2.0%)	37 (3.3%)	0.620
	Obesity	9 (10.2%)	72 (7.5%)	0.370	5 (3.3%)	36 (3.2%)	0.950
	Paralysis	1 (1.1%)	10 (1.0%)	0.999	6 (4.0%)	15 (1.4%)	**0.017**
	Peripheral Vascular Disorders	8 (9.1%)	527 (55.2%)	**<0.001**	9 (6.0%)	583 (52.5%)	**<0.001**
	Psychoses	2 (2.3%)	12 (1.3%)	0.330	5 (3.3%)	6 (0.5%)	**0.001**
	Pulmonary Circulation Disorders	0 (0%)	1 (0.1%)	0.999	2 (1.3%)	1 (0.1%)	**0.039**
	Renal Failure	9 (10.2%)	59 (6.2%)	0.140	20 (13.3%)	138 (12.4%)	0.750
	Solid Tumor	2 (2.3%)	11 (1.2%)	0.300	8 (5.3%)	17 (1.5%)	**0.002**
	Peptic Ulcer	0 (0%)	0 (0%)		0 (0%)	0 (0%)	
	Valvular Disease	3 (3.4%)	6 (0.6%)	**0.034**	10 (6.7%)	6 (0.5%)	**<0.001**
	Weight Loss	2 (2.3%)	12 (1.3%)	0.330	7 (4.7%)	20 (1.8%)	**0.023**
Embolism/ Thrombosis Location	Abdominal Aorta	9 (10.2%)	237 (24.8%)	**<0.001**	6 (4.0%)	147 (13.2%)	**<0.001**
	Thoracic Aorta	2 (2.3%)	0 (0%)		1 (0.7%)	1 (0.1%)	
	Upper Extremity	15 (17.0%)	64 (6.7%)		23 (15.3%)	47 (4.2%)	
	Lower Extremity	54 (61.4%)	483 (50.6%)		108 (72.0%)	742 (66.8%)	
	Iliac Artery	8 (9.1%)	171 (17.9%)		12 (8.0%)	173 (15.6%)	
Invasive Diagnostic Procedure		9 (10.2%)	13 (1.4%)	**<0.001**	2 (1.3%)	19 (1.7%)	0.999
Deceased		0 (0%)	9 (0.9%)	0.999	4 (2.7%)	21 (1.9%)	0.530
		Mean (SD)	Mean (SD)	p	Mean (SD)	Mean (SD)	p
Age, Years		52.68 (8.58)	54.74 (7.20)	**0.045**	78.34 (8.05)	75.13 (7.09)	**<0.001**
Time to Invasive Diagnostic Procedure, Days		0.88 (1.13)	1.40 (1.96)	0.900	0.50 (0.71)	1.85 (3.31)	0.999
Modified Frailty Index Score		1.30 (1.11)	1.26 (0.92)	0.760	1.50 (1.07)	1.54 (0.92)	0.650
Hospital Length of Stay, Days		3.86 (3.89)	4.69 (4.80)	**0.033**	4.22 (4.45)	5.00 (6.16)	0.140
Total Charges, Dollars		20,480 (17,693)	50,247 (45,923)	**<0.001**	19,645 (19,533)	53,742 (51,981)	**<0.001**

Table 5: Characteristics of emergency admitted adult patients by location of the primary EGS diagnosis arterial embolism and thrombosis, NIS 2004-2014.

Patients' Characteristics		Location of Arterial Embolism/Thrombosis, N (%)					p
		Abdominal	Thoracic	Upper Extremity	Lower Extremity	Iliac	
All Cases		246 (23.6%)	2 (0.2%)	79 (7.6%)	537 (51.5%)	179 (17.2%)	
Sex, Female		118 (48.0%)	2 (100%)	36 (45.6%)	191 (35.6%)	70 (39.3%)	**0.005**
Race	White	146 (81.1%)	0 (0%)	48 (80.0%)	292 (70.2%)	104 (84.6%)	0.170
	Black	22 (12.2%)	0 (0%)	7 (11.7%)	78 (18.8%)	11 (8.9%)	
	Hispanic	7 (3.9%)	0 (0%)	4 (6.7%)	34 (8.2%)	4 (3.3%)	
	Asian/Pacific Islander	2 (1.1%)	0 (0%)	0 (0%)	3 (0.7%)	1 (0.8%)	
	Native American	0 (0%)	0 (0%)	0 (0%)	2 (0.5%)	1 (0.8%)	
	Other	3 (1.7%)	0 (0%)	1 (1.7%)	7 (1.7%)	2 (1.6%)	
Income Quartile	Quartile 1	97 (40.8%)	0 (0%)	15 (19.7%)	179 (34.6%)	50 (28.9%)	**0.009**
	Quartile 2	65 (27.3%)	0 (0%)	22 (28.9%)	146 (28.2%)	53 (30.6%)	
	Quartile 3	44 (18.5%)	2 (100%)	18 (23.7%)	111 (21.4%)	35 (20.2%)	
	Quartile 4	32 (13.4%)	0 (0%)	21 (27.6%)	82 (15.8%)	35 (20.2%)	
Insurance	Private Insurance	140 (57.1%)	2 (100%)	48 (60.8%)	302 (56.7%)	106 (59.2%)	0.790
	Medicare	48 (19.6%)	0 (0%)	12 (15.2%)	130 (24.4%)	43 (24.0%)	
	Medicaid	37 (15.1%)	0 (0%)	10 (12.7%)	56 (10.5%)	18 (10.1%)	
	Self-Pay	12 (4.9%)	0 (0%)	3 (3.8%)	20 (3.8%)	5 (2.8%)	
	No Charge	1 (0.4%)	0 (0%)	0 (0%)	2 (0.4%)	0 (0%)	
	Other	7 (2.9%)	0 (0%)	6 (7.6%)	23 (4.3%)	7 (3.9%)	
Hospital Location	Rural	31 (12.6%)	0 (0%)	3 (3.8%)	61 (11.4%)	26 (14.5%)	0.310
	Urban: Non-Teaching	106 (43.1%)	2 (100%)	37 (46.8%)	232 (43.2%)	71 (39.7%)	
	Urban: Teaching	109 (44.3%)	0 (0%)	39 (49.4%)	244 (45.4%)	82 (45.8%)	
Comorbidities	AIDS	2 (0.8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0.170
	Alcohol Abuse	11 (4.5%)	0 (0%)	0 (0%)	14 (2.6%)	4 (2.2%)	0.270
	Deficiency Anemias	30 (12.2%)	0 (0%)	7 (8.9%)	45 (8.4%)	14 (7.8%)	0.450
	Rheumatoid Arthritis	1 (0.4%)	0 (0%)	4 (5.1%)	13 (2.4%)	2 (1.1%)	0.070
	Chronic Blood Loss	3 (1.2%)	0 (0%)	1 (1.3%)	3 (0.6%)	1 (0.6%)	0.850
	Congestive Heart Failure	1 (0.4%)	0 (0%)	1 (1.3%)	8 (1.5%)	2 (1.1%)	0.780
	Chronic Pulmonary Disease	95 (38.6%)	2 (100%)	15 (19.0%)	118 (22.0%)	46 (25.7%)	**<0.001**
	Coagulopathy	9 (3.7%)	0 (0%)	1 (1.3%)	7 (1.3%)	7 (3.9%)	0.140
	Depression	8 (3.3%)	0 (0%)	3 (3.8%)	29 (5.4%)	12 (6.7%)	0.520
	Diabetes, Uncomplicated	30 (12.2%)	0 (0%)	12 (15.2%)	140 (26.1%)	28 (15.6%)	**<0.001**
	Diabetes, Chronic Complications	7 (2.8%)	0 (0%)	4 (5.1%)	40 (7.4%)	5 (2.8%)	**0.038**
	Drug Abuse	2 (0.8%)	0 (0%)	1 (1.3%)	6 (1.1%)	3 (1.7%)	0.950
	Hypertension	151 (61.4%)	1 (50.0%)	41 (51.9%)	342 (63.7%)	96 (53.6%)	0.080
	Hypothyroidism	14 (5.7%)	0 (0%)	2 (2.5%)	25 (4.7%)	6 (3.4%)	0.700
	Liver Disease	4 (1.6%)	0 (0%)	2 (2.5%)	6 (1.1%)	4 (2.2%)	0.780
	Lymphoma	2 (0.8%)	0 (0%)	1 (1.3%)	2 (0.4%)	0 (0%)	0.630
	Fluid/Electrolyte Disorders	42 (17.1%)	1 (50.0%)	8 (10.1%)	27 (5.0%)	9 (5.0%)	**<0.001**
	Metastatic Cancer	1 (0.4%)	0 (0%)	4 (5.1%)	5 (0.9%)	1 (0.6%)	**0.008**
	Other Neurological Disorders	10 (4.1%)	0 (0%)	1 (1.3%)	18 (3.4%)	5 (2.8%)	0.790
	Obesity	16 (6.5%)	0 (0%)	13 (16.5%)	43 (8.0%)	9 (5.0%)	**0.027**
	Paralysis	6 (2.4%)	0 (0%)	1 (1.3%)	3 (0.6%)	1 (0.6%)	0.180
	Peripheral Vascular Disorders	155 (63.0%)	0 (0%)	19 (24.1%)	260 (48.4%)	101 (56.4%)	**<0.001**
	Psychoses	7 (2.8%)	0 (0%)	0 (0%)	6 (1.1%)	1 (0.6%)	0.180
	Pulmonary Circulation Disorders	0 (0%)	0 (0%)	0 (0%)	1 (0.2%)	0 (0%)	0.920
	Renal Failure	7 (2.8%)	1 (50.0%)	7 (8.9%)	49 (9.1%)	4 (2.2%)	**<0.001**
	Solid Tumor	4 (1.6%)	0 (0%)	1 (1.3%)	4 (0.7%)	4 (2.2%)	0.590
	Peptic Ulcer	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
	Valvular Disease	0 (0%)	2 (100%)	2 (2.5%)	5 (0.9%)	0 (0%)	**<0.001**
	Weight Loss	10 (4.1%)	0 (0%)	1 (1.3%)	2 (0.4%)	1 (0.6%)	**0.001**
Invasive Diagnostic Procedure		4 (1.6%)	0 (0%)	0 (0%)	14 (2.6%)	4 (2.2%)	0.610
Surgical Procedure		237 (96.3%)	0 (0%)	64 (81.0%)	483 (89.9%)	171 (95.5%)	**<0.001**
Invasive or Surgical Procedure		240 (97.6%)	0 (0%)	64 (81.0%)	487 (90.7%)	173 (96.6%)	**<0.001**
Deceased		4 (1.6%)	0 (0%)	0 (0%)	2 (0.4%)	3 (1.7%)	0.260
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	p
Age, Years		55.03 (6.61)	62.00 (-)	48.80 (10.23)	54.90 (7.11)	55.38 (6.40)	**<0.001**
Modified Frailty Index Score		1.30 (0.90)	2.00 (1.41)	1.11 (0.89)	1.33 (0.97)	1.07 (0.86)	**0.007**
Time to Invasive Diagnostic Procedure, Days		0.75 (0.96)	-(-)	-(-)	1.64 (1.86)	0 (0)	0.270
Time to Surgical Procedure, Days		0.45 (1.65)	-(-)	0.77 (1.81)	0.50 (1.42)	0.16 (0.63)	**0.025**
Hospital Length of Stay, Days		6.96 (5.78)	1.00 (0)	4.15 (4.52)	4.01 (4.30)	3.48 (3.22)	**<0.001**
Total Charges, Dollars		61,517 (58,938)	10,519 (2,484)	30,349 (26,871)	46,439 (42,108)	40,674 (30,934)	**<0.001**

Table 6: Characteristics of emergency admitted elderly patients by location of the primary EGS diagnosis arterial embolism and thrombosis, NIS 2004-2014.

Patients' Characteristics		Location of Arterial Embolism/Thrombosis, N (%)					p
		Abdominal	Thoracic	Upper Extremity	Lower Extremity	Iliac	
All Cases		153 (12.1%)	2 (0.2%)	70 (5.6%)	850 (67.5%)	185 (14.7%)	
Sex, Female		93 (60.8%)	0 (0%)	45 (64.3%)	406 (47.8%)	74 (40.0%)	**<0.001**
Race	White	103 (82.4%)	1 (100%)	339 (79.6%)	518 (78.1%)	124 (87.9%)	0.760
	Black	12 (9.6%)	0 (0%)	6 (12.2%)	61 (9.2%)	8 (5.7%)	
	Hispanic	4 (3.2%)	0 (0%)	3 (6.1%)	54 (8.1%)	4 (2.8%)	
	Asian/Pacific Islander	2 (1.6%)	0 (0%)	0 (0%)	5 (0.8%)	2 (1.4%)	
	Native American	1 (0.8%)	0 (0%)	0 (0%)	4 (0.6%)	1 (0.7%)	
	Other	3 (2.4%)	0 (0%)	1 (2.0%)	21 (3.2%)	2 (1.4%)	
Income Quartile	Quartile 1	42 (28.8%)	2 (100%)	25 (35.7%)	255 (30.5%)	48 (26.2%)	0.440
	Quartile 2	41 (28.1%)	0 (0%)	13 (18.6%)	231 (27.7%)	53 (29.0%)	
	Quartile 3	37 (25.3%)	0 (0%)	13 (18.6%)	182 (21.8%)	42 (23.0%)	
	Quartile 4	26 (17.8%)	0 (0%)	19 (27.1%)	167 (20.0%)	40 (21.9%)	
Insurance	Private Insurance	16 (10.5%)	0 (0%)	5 (7.1%)	67 (7.9%)	20 (10.8%)	0.600
	Medicare	131 (85.6%)	2 (100%)	65 (92.9%)	768 (90.6%)	160 (86.5%)	
	Medicaid	2 (1.3%)	0 (0%)	0 (0%)	8 (0.9%)	1 (0.5%)	
	Self-Pay	2 (1.3%)	0 (0%)	0 (0%)	2 (0.2%)	1 (0.5%)	
	No Charge	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
	Other	2 (1.3%)	0 (0%)	0 (0%)	3 (0.4%)	3 (1.6%)	
Hospital Location	Rural	15 (9.8%)	2 (100%)	7 (10.1%)	111 (13.1%)	11 (5.9%)	
	Urban: Non-Teaching	83 (54.2%)	0 (0%)	28 (40.6%)	389 (45.8%)	85 (45.9%)	**<0.001**
	Urban: Teaching	55 (35.9%)	0 (0%)	34 (49.3%)	350 (41.2%)	89 (48.1%)	
Comorbidities	AIDS	0 (0%)	0 (0%)	0 (0%)	1 (0.1%)	0 (0%)	0.980
	Alcohol Abuse	2 (1.3%)	0 (0%)	0 (0%)	12 (1.4%)	3 (1.6%)	0.890
	Deficiency Anemias	22 (14.4%)	0 (0%)	8 (11.4%)	98 (11.5%)	22 (11.9%)	0.860
	Rheumatoid Arthritis	4 (2.6%)	0 (0%)	2 (2.9%)	17 (2.0%)	2 (1.1%)	0.840
	Chronic Blood Loss	4 (2.6%)	0 (0%)	2 (2.9%)	8 (0.9%)	3 (1.6%)	0.380
	Congestive Heart Failure	1 (0.7%)	0 (0%)	3 (4.3%)	30 (3.5%)	3 (1.6%)	0.240
	Chronic Pulmonary Disease	67 (43.8%)	0 (0%)	11 (15.7%)	199 (23.4%)	60 (32.4%)	**<0.001**
	Coagulopathy	10 (6.5%)	0 (0%)	1 (1.4%)	24 (2.8%)	2 (1.1%)	**0.043**
	Depression	4 (2.6%)	0 (0%)	3 (4.3%)	31 (3.6%)	6 (3.2%)	0.960
	Diabetes, Uncomplicated	35 (22.9%)	1 (50.0%)	17 (24.3%)	235 (27.6%)	43 (23.2%)	0.500
	Diabetes, Chronic Complications	6 (3.9%)	0 (0%)	3 (4.3%)	60 (7.1%)	8 (4.3%)	0.380
	Drug Abuse	0 (0%)	0 (0%)	0 (0%)	1 (0.1%)	0 (0%)	0.980
	Hypertension	108 (70.6%)	1 (50.0%)	48 (68.6%)	608 (71.5%)	126 (68.1%)	0.840
	Hypothyroidism	16 (10.5%)	0 (0%)	10 (14.3%)	78 (9.2%)	11 (5.9%)	0.280
	Liver Disease	2 (1.3%)	0 (0%)	0 (0%)	6 (0.7%)	0 (0%)	0.590
	Lymphoma	1 (0.7%)	0 (0%)	1 (1.4%)	1 (0.1%)	3 (1.6%)	0.060
	Fluid/Electrolyte Disorders	32 (20.9%)	0 (0%)	6 (8.6%)	62 (7.3%)	17 (9.2%)	**<0.001**
	Metastatic Cancer	1 (0.7%)	0 (0%)	2 (2.9%)	14 (1.6%)	2 (1.1%)	0.740
	Other Neurological Disorders	1 (0.7%)	0 (0%)	2 (2.9%)	36 (4.2%)	1 (0.5%)	**0.032**
	Obesity	3 (2.0%)	0 (0%)	6 (8.6%)	22 (2.6%)	10 (5.4%)	**0.026**
	Paralysis	2 (1.3%)	0 (0%)	2 (2.9%)	16 (1.9%)	1 (0.5%)	0.660
	Peripheral Vascular Disorders	113 (73.9%)	0 (0%)	12 (17.1%)	355 (41.8%)	112 (60.5%)	**<0.001**
	Psychoses	2 (1.3%)	0 (0%)	1 (1.4%)	7 (0.8%)	1 (0.5%)	0.930
	Pulmonary Circulation Disorders	0 (0%)	0 (0%)	2 (2.9%)	1 (0.1%)	0 (0%)	**<0.001**
	Renal Failure	23 (15.0%)	0 (0%)	12 (17.1%)	105 (12.4%)	18 (9.7%)	0.430
	Solid Tumor	2 (1.3%)	0 (0%)	3 (4.3%)	17 (2.0%)	3 (1.6%)	0.660
	Peptic Ulcer	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
	Valvular Disease	1 (0.7%)	1 (50.0%)	2 (2.9%)	11 (1.3%)	1 (0.5%)	**<0.001**
	Weight Loss	6 (3.9%)	0 (0%)	0 (0%)	13 (1.5%)	8 (4.3%)	**0.048**
Invasive Diagnostic Procedure		4 (2.6%)	0 (0%)	2 (2.9%)	13 (1.5%)	2 (1.1%)	0.740
Surgical Procedure		147 (96.1%)	1 (50.0%)	47 (67.1%)	742 (87.3%)	173 (93.5%)	**<0.001**
Invasive or Surgical Procedure		148 (96.7%)	1 (50.0%)	47 (67.1%)	743 (87.4%)	173 (93.5%)	**<0.001**
Deceased		7 (4.6%)	0 (0%)	2 (2.9%)	13 (1.5%)	3 (1.6%)	0.160
		Mean (SD)	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**p**
Age, Years		71.44 (5.53)	67.00 (1.41)	76.97 (8.23)	76.64 (7.38)	73.22 (5.84)	**<0.001**
Modified Frailty Index Score		1.67 (0.98)	1.00 (1.41)	1.46 (0.93)	1.53 (0.94)	1.48 (0.90)	0.280
Time to Invasive Diagnostic Procedure, Days		0 (0)	-(-)	1.00 (-)	2.40 (3.63)	0 (-)	0.670
Time to Surgical Procedure, Days		0.27 (1.63)	-(-)	0.53 (1.18)	0.54 (2.22)	0.28 (0.94)	0.320
Hospital Length of Stay, Days		6.59 (6.19)	2.00 (1.41)	4.31 (3.67)	4.81 (6.11)	4.23 (5.76)	**0.003**
Total Charges, Dollars		71,244 (56,850)	17,970 (16,893)	34,388 (31,639)	47,406 (46,502)	48,777 (62,764)	**<0.001**

Table 7. Backward logistic regression analysis to evaluate the associations between mortality and different factors in emergency-admitted patients with the primary diagnosis of arterial embolism and thrombosis who had an operation. Mortality was the dependent variable. NIS 2004-2014.

Patients' Characteristics	Adults with Operation		Elderly with Operation	
	OR (95% CI)	P	OR (95% CI)	P
Modified Frailty Index Score	1.714 (0.836, 3.514)	0.14	1.810 (1.151, 2.846)	**0.01**
Time to Operation, Days	1.043 (0.691, 1.575)	0.84	**Removed**	
Sex, Female			2.850 (1.094,7.423)	**0.03**
Age, Years				
Race				
Income Quartile	**Removed Via Backward Elimination**		**Removed Via Backward Elimination**	
Embolism/Thrombosis Location				
Health Care Insurance				
Hospital Location				

Discussion

Our findings have demonstrated that in operated patients with arterial thromboembolism, admitted emergently to the hospital, delayed operation and frailty index for adults, and female sex and frailty index for elderly were the main risk factors of mortality.

Frailty index and Mortality

In support of our results, previous studies have shown that frailty index is an important predictive variable in emergency general surgery patients and therefore can be used to assess risk of morbidity and mortality in these cases and serve as an invaluable preoperative risk assessment tool for the acute care surgeon.

Delayed Operation and Mortality

Additionally, in support of our conclusions, delayed operating room access for emergency surgery have been shown to be associated with increased risk of in hospital mortality and longer length of stay. In several NIS studies, delayed operation emerged as a risk factor for mortality in patients with chronic duodenal ulcer, hemorrhoids or ventral hernia who emergently admitted and underwent an operation.

Gender and Mortality

Male patients manifested a lower mortality rate compared in comparison with female patients. This findings are consistent with regional studies that have showed a significantly higher mortality for women undergoing surgical revascularization for peripheral arterial disease. Additional suggested explanations for sex differences in outcome have included the delayed recognition of vascular disease in women as a result of the presumed atheroprotective effects of reproductive hormones and the prescription of fewer antiplatelet and lipid-lowering agents to treat atherosclerotic disease in women In terms of anatomic elements, females have been shown to have smaller native and conduit vessel sizes, both of which have been correlated with poor surgical outcomes. Furthermore, a higher likelihood of periprocedural bleeding and infectious complications leading to higher morbidity and mortality has been demonstrated among female patients.

Age and Mortality

Previous studies have shown that the risk of ATE was increased in patients with higher age, male sex, and hypertension. There is an exponential increase in the risk of arterial thrombotic events with age, and the increase in life expectancy in the second half of the 20th century is a major contributor to increase in ATE events. Plasma concentrations of some coagulation factors (factors V, VII, VIII, and IX, fibrinogen) increase progressively with age and may play a causative role in the high rate of cardiovascular events observed in elderly people. During aging, an enhanced activity of coagulation enzymes is expressed an impairment of fibrinolytic activity, and an increase in platelet reactivity. Advanced age is characterised by stiffness and dilation of the arteries, due to degeneration of elastic fibres and an increase in collagen and calcium content, and by a decrease in prostacyclin and nitric oxide with a related reduction in endothelium-dependent dilation There is also increased binding of platelet-derived growth factor to arteries, caused by changes in the glycosaminoglycan content of the vessel wall, which enhances the progression of atherosclerosis and indirectly contributes to atherothrombosis. The higher mortality in older age can be explained by a higher postoperative complication risk in older adults as a result of higher rate of comorbidities. Comorbid conditions, as expected, found to have a substantial adverse effect on postoperative outcomes. Hypertension, deficiency anemias, fluid/electrolyte disorders, uncomplicated diabetes, peripheral vascular disease and chronic pulmonary disease have shown to be associated with increased mortality rates.

Comorbidities

Deficiencies Anemias, Surgery and Mortality

In multivariate analysis, use of RBC to deficiency anemia cancer patients, was significantly associated with VTE, ATE, and in-hospital mortality after adjusting for other covariates. Anemia is a marker of increased risk during interventional procedure and poor midterm survival after percutaneous coronary intervention. Preoperative anemia was recognized risk factors for operative mortality resulting in increased length of hospital stay, post-operative complications and death. Anemia has been associated with myocardial ischemia and cardiac morbidity, increased mortality in the presence of significant medical or surgical conditions such as MI , heart failure, hematologic malignancy, renal failure vascular surgery, and radical prostatectomy.

Hypertension, Surgery and Mortality

Hypertension is a major risk factor for causing coronary events, stroke, heart failure, peripheral arterial disease, dissecting aneurysm, chronic kidney disease, and mortality Hypertension in the perioperative and postoperative period increases cardiovascular events, cerebrovascular events, bleeding, mortality and increase in HLOS.

Fluid/electrolyte disorders Surgery and Mortality

The increased morality seen in patients with fluid/electrolyte disorders is consistent with previous studies which have highlighted the significant prevalence of hyponatremia and hypernatremia in surgical patients. Both were significantly and independently associated with postoperative thromboembolism, mortality, morbidity, major bleeding and return to operation room. The effect of hyponatremia on thromboembolic outcome was evident across all age groups, both sexes, patients with or without steroid treatment. The preoperative hypernatremia is associated with increased perioperative 30-day morbidity and mortality .

Diabetes, Surgery and Mortality

Patients with diabetes are at increased risk of morbidity and mortality from CVD. Diabetes is the strongest risk factors of occlusive arterial disease. Both extensive vascular pathology and an enhanced thrombotic environment contribute to premature vascular occlusive events and poor clinical outcome in patients with diabetes. Endothelial cell dysfunction plays a role in all stages of the atherosclerotic process from initiation of atherosclerosis to precipitation of thrombosis Therefore, it has been associated with increase rates of surgical complications and death.

As with any retrospective cohort analysis, there is a level if inherent limitation to the data, hence, it is important to interpret that data with that in mind. Due to the fact that it is a retrospective study using an administrative dataset, there are variables that cannot be obtained, which would help greatly to further contextualize the results. Given that the principal goal of the study was to identify factors that influence postoperative in-hospital mortality in emergency surgery of arterial emboli and thrombus, it would be beneficial to add an additional element of analysis of the causes of death among patients to satisfy the association notes by cause. Furthermore, measuring mortality attributable to arterial emboli and thrombus is challenging for because of the multifactorial nature of death and the low rates of autopsy in most states. Without a standard method to measure arterial emboli and thrombus -associated mortality, it is challenging to point out reliable representative and comparable estimates across demographic and socioeconomic groups. Another such contextualizing aspect that is missing, given the analysis of patient disposition, is an assessment of functional ability prior to emergency surgery. By identifying the level of care required by the patient, such as home health or skilled nursing facility, there would be a more nuanced understanding of whether or not the disposition is a return to the status quo or an escalation in care status needed by the patient. Additionally, as comorbidities were among the most influential factors that increased mortality in both associations, it would be beneficial to comprehend on how multiple comorbidities potentially interact to impact postoperative recovery of revascularization, due to the synergistic impact on physical stress.

Strengths of the Study

The Healthcare Cost and Utilization Project (HCUP) was established to provide multistate, administrative, population-based data on patients in a uniform format. The data are designed for health services research to enhance health care provision. The National Inpatient Sample (NIS), a large administrative database produced by the Agency for Healthcare Research and Quality (AHRQ), has been progressively used publicly as a countrywide data source, holding much potential and support for the assessment of patterns of care and outcomes for research. It allows novel approaches to investigate disease conditions, optimal care, and patient outcomes. The analysis of the epidemiology of a large sample size of patients with arterial thromboembolism can provide additional insights. Previous studies assessing the prevalence of arterial thromboembolism were confined to small populations from single hospitals or geographic regions. The epidemiology and the demographics of arterial thromboembolism in the total population and its impact on hospitalization and complications, and morbidity and mortality have not been examined. Our study fills part of the gap in our expands the evidence base and helps further understanding arterial thromboembolism in adults and elderly, separately.

Limitations of the Study

Several limitations have to be mentioned in this retrospective analysis. In future studies, the quality of the reported data would benefit from the severity of arterial thromboembolism associated complications. Additionally, the retrospective design, had limitations in recognizing several confounding factors such as the choice of operative approach, the surgeon's level of training, severity of comorbidities, cause of death, and any further modifiable factors that impact postoperative outcomes.

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