Delayed Surgical Management of Type A Intramural Hematoma Is Not Associated with Worse Outcomes Than Emergent Operation

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ABSTRACT

Objectives: Management of acute aortic intramural hematomas (IMHs) involving the ascending aorta and root remains controversial. Some series have suggested that delaying operative intervention beyond the first 24-hours may be beneficial.

Methods: A retrospective single-institution analysis was performed to identify patients presenting with type A IMH. These patients were classified by whether they underwent surgery within 24 hours or delayed operative intervention. Patients with additional indications for emergent operation, such as acute aortic regurgitation or malperfusion syndromes, were excluded. Outcomes were assessed with logistic regression, and the Kaplan–Meier method was used to analyze long-term survival.

Results: Of the 129 patients with acute type A aortic pathology, 36 (27.9%) presented with isolated IMH. IMH patients were less likely to present with acute aortic regurgitation (8.6% versus 27.9%, P = .020) or limb ischemia (0% versus 12.6%, P = .027). Of the IMH patients without other emergent operative indications, 23 (67.6%) underwent surgery within 24 hours. Delayed operative repair was not associated with increased risk of mortality, stroke, or renal failure (all P >.05). Survival analysis showed no difference in survival at 1 year.

Conclusions: In well-selected patients, delayed operation for type An intramural hematoma is not associated with adverse outcomes.

BACKGROUND

Acute aortic syndrome represents a spectrum of pathology ranging from aortic dissection and penetrating atherosclerotic ulcer to intramural hematoma. Classically, the presence of a Stanford type A aortic dissection has necessitated emergent operative repair, given the grave threat to life associated with

the natural history of the disease. However, although great strides have been made in refining the surgical management of type A aortic dissections, the operation remains associated with significant morbidity and mortality [Trimarchi 2005].

The management of acute aortic intramural hematomas (IMHs) involving the ascending aorta and root remains controversial. Because the pathophysiology of IMH and risk of catastrophic complication may be lower than other acute aortic pathologies, some series have suggested that delaying operative intervention beyond the first 24 hours may be beneficial [Sandhu 2016]. We sought to review our institutional case series of the management of type A IMH.

Methods

A single-institution retrospective analysis was performed to identify patients presenting with type A acute aortic pathology between the years of 1990 and 2018. Patients were stratified by the presence or absence of IMH in the aortic root or ascending aorta on computed tomography. IMH patients were classified by whether they underwent surgery within 24 hours or delayed operative intervention. Following classification, patients with both a dissection flap and intramural hematoma, or additional indications for emergent operation, such as acute aortic regurgitation or malperfusion syndromes, were excluded from the primary analysis.

The primary outcome was all-cause mortality. The major morbidities recognized by the Society of Thoracic Surgeons (stroke, pneumonia, atrial fibrillation, prolonged intubation, and renal failure) were analyzed as secondary outcomes. Student t test and the chi-square test of independence were used
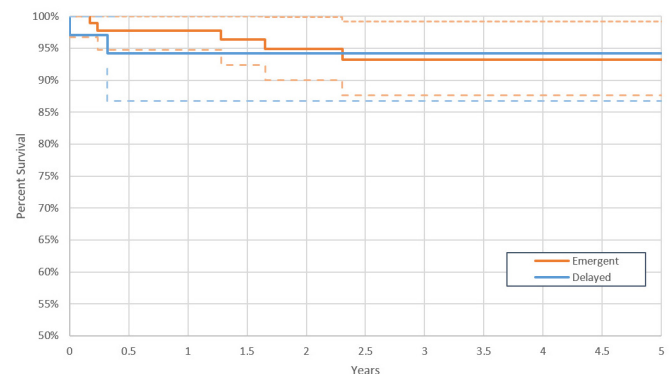
Kaplan–Meier survival comparing emergent and delayed operations. Ninety-five percent confidence intervals expressed by dashed lines.

Table 1. Baseline Characteristics of Patients Presenting with Acute Aortic Syndrome

Demographics	No Hematoma*	Intramural Hematoma*	P
Age, years (SD)	55.4 (15.1)	60.4 (18.1)	.35
Gender, male	74 (79.6%)	16 (44.4%)	<.001
Ethnicity			
White	50 (53.8%)	23 (63.9%)	.34
African American	33 (35.5%)	9 (25.0%)	.40
Hispanic	0 (0.0%)	2 (5.6%)	.33
Body mass index			.470
Past medical history			
Hypertension	79 (84.9%)	30 (83.3%)	.97
Diabetes	5 (4.3%)	8 (22.2%)	.006
Peripheral arterial disease	3 (3.2%)	1 (2.8%)	.57
Stroke	71 (76.3%)	6 (1.7%)	.99
Chronic lung disease	6 (6.5%)	3 (8.3%)	.64
End-stage renal disease	4 (4.3%)	1 (2.8%)	.59
Congestive heart failure	9 (9.7%)	2 (5.6%)	.32
Atrial fibrillation	1 (1.1%)	1 (2.7%)	.58
Preoperative lab results			
Hematocrit, vol% (SD)	36.73 (6.16)	34.83 (7.04)	.37
Platelet count, ×1000/μL, no. (SD)	193.6 (91.1)	167.0 (56.2)	.31
INR (SD)	1.20 (0.28)	1.13 (0.17)	.35
Findings at presentation			
Aortic regurgitation	24 (27.9%)	3 (8.6%)	.02
Coronary involvement	9 (10.3%)	2 (5.7%)	.423
Pericardial effusion	20 (23.0%)	8 (22.9%)	.988
Limb ischemia	11 (12.6%)	0 (0.0%)	.027
Acute renal failure	6 (6.9%)	3 (8.6%)	.751

*Data is n (%) unless otherwise indicated.

to compare baseline characteristics between groups. The primary and secondary outcomes were analyzed by using logistic regression. Survival analysis was performed with the Kaplan–Meier method.

RESULTS

A total of 129 patients were identified with acute type A aortic pathology. Of them, 36 (27.9%) presented with IMH. Patients with and without IMH had similar ages and distributions of ethnicities, although IMH patients were less likely to be male. Past medical history was similar between the 2 groups, although IMH patients were significantly

Table 2. Logistic Regression of Outcomes Comparing Patients with and without Intramural Hematoma

| | Estimate | | | |
Outcome	No Hematoma	Hematoma	Odds Ratio (95% Confidence Interval)	P
30-Day mortality	1.8%	4.7%	2.63 (0.36-19.32)	.34
Pneumonia	8.9%	8.3%	0.94 (0.18-4.83)	.94
Sepsis	10.3%	7.7%	0.72 (0.07-7.68)	.79
Stroke	18.5%	10.0%	0.49 (0.16-1.53)	.22
Acute renal failure	20.3%	24.0%	1.24 (0.43-3.62)	.69
Atrial fibrillation	31.6%	29.2%	0.89 (0.33-2.42)	.82
Prolonged intubation	64.6%	66.7%	1.10 (0.42-2.88)	.85
Readmission	15.7%	25.9%	1.88 (0.67-5.27)	.23

more likely to have diabetes (22.2% versus 4.3%, P = .006) (Table 1).

IMH patients were less likely to present with an emergent indication for surgical intervention. In particular, they were less likely to have aortic regurgitation (8.6% versus 27.9%, P = 0.020) or limb ischemia (0% versus 12.6%, P = .027). Rates of coronary involvement, pericardial effusion, or renal failure were similar between the 2 groups. Preoperatively, both groups had similar hematocrit level, platelet count, and prothrombin time. A significant proportion of the patients with IMH had hematoma involvement in the aortic root (n = 6, 18.8%) or extension to the descending aorta (n = 17, 51.5%), but outcomes following operative management were similar when they were analyzed in logistic regression (Table 2).

Of the patients who presented with type A IMH without an emergent indication for surgery, 23 (67.6%) underwent operative intervention within 24 hours. There was no statistically significant difference in demographics, past medical history, or risk factors between patients who underwent surgery early or late. Both groups had similar hematocrit level, platelet count, and prothrombin time prior to surgery. The proportion of patients with hematoma involvement in the aortic root, aortic arch, or descending aorta was not significantly different between groups (Table 3). Of note, there were 5 IMH patients who presented with acute indications for operative intervention who did not have surgery within 24 hours for various reasons, including prohibitively high operative risk. Patients with these findings were not included in the primary survival analysis comparing the 2 groups.

In logistic regression, there was no significant difference in the rates of complications between the 2 groups (Table 4). Prolonged intubation greater than 48 hours was common in both groups, affecting 66.7% of the early and 70.0% of the delayed intervention groups. The delayed intervention group did have higher rates of acute renal failure and atrial fibrillation, but these differences did not reach statistical significance. Rates of pneumonia and stroke were similar between the 2 groups.

Table 3. Comparison between Patients Receiving Emergent or Delayed Surgery for Intramural Hematoma

Demographics	Early*	Delayed*	P
Age, years (SD)	60.0 (17.8)	66.2 (12.9)	.515
Gender, male	10 (43.5%)	4 (36.4%)	.705
Ethnicity			
White	14 (60.9%)	6 (54.5%)	.861
African American	5 (21.7%)	4 (36.4%)	.420
Body mass index	29.7 (6.8)	30.3 (4.5)	.886
Past medical history			
Hypertension	20 (87.0%)	9 (81.8%)	.893
Diabetes	5 (21.7%)	3 (27.3%)	.954
Peripheral arterial disease	1 (4.3%)	0 (0.0%)	.327
Stroke	6 (26.1%)	2 (18.1%)	.851
Chronic lung disease	1 (4.3%)	1 (9.1%)	.728
End-stage renal disease	1 (4.3%)	0 (0.0%)	.330
Congestive heart failure	1 (4.3%)	1 (9.1%)	.661
Atrial fibrillation	1 (4.3%)	0 (0.0%)	.328
Preoperative lab results			
Hematocrit, vol% (SD)	32.5 (6.6)	36.9 (8.1)	.304
Platelet count, ×1000/μL, no. (SD)	182.0 (63.6)	147.6 (52.1)	.334
INR (SD)	1.14 (0.12)	1.12 (0.28)	.876
Findings at presentation			
Aortic regurgitation	1 (4.3%)	1 (9.1%)	.596
Coronary involvement	1 (4.3%)	1 (9.1%)	.596
Pericardial effusion	5 (21.7%)	3 (27.3%)	.732
Acute renal failure	2 (8.7%)	1 (9.1%)	.971
Hematoma location			
Aortic root	3 (14.3%)	3 (30.0%)	.317
Ascending aorta	8 (38.0%)	4 (36.4%)	.298
Aortic arch	14 (66.6%)	6 (54.5%)	.260
Descending aorta	12 (57.1%)	4 (36.4%)	.279

*Data is n (%) unless otherwise indicated.

In Kaplan–Meier survival analysis, survival at 1 year was 97.7% for the early intervention group and 97.1% for the delayed intervention group (Figure). At 5 years, survival was 93.2% and 94.2% for the early and delayed groups, respectively. Log-rank test revealed no statistically significant difference between the 2 groups.

CONCLUSIONS

Our analysis demonstrated no increased morbidity associated with delayed operative intervention for type A IMH.

Table 4. Logistic Regression of Outcomes Comparing Emergent and Delayed Operations

	Estimate			
Outcome	Emergent	Delayed	Odds Ratio (95% Confidence Interval)	P
Pneumonia	8.3%	10.0%	1.22 (0.07-22.40)	.89
Stroke	12.0%	7.7%	0.61 (0.06-6.54)	.68
Acute renal failure	23.1%	30.0%	1.43 (0.22-9.26)	.71
Atrial fibrillation	16.7%	40.0%	3.33 (0.46-24.05)	.23
Prolonged intubation	66.7%	70.0%	1.17 (0.19-7.12)	.87

Overall, both groups of patients did well, with 5-year survival of greater than 90%. Although the rates of renal failure and atrial fibrillation did appear to be higher in the delayed intervention group, these findings did not reach statistical significance, and there were no significant differences detected in any of the Society of Thoracic Surgeons major morbidities. Overall, these results suggest that in well-selected patients, delaying surgical repair of type A IMH does not increase the risk of morbidity or short- or long-term mortality.

However, as a retrospective, single-institutional series, this analysis faces several limitations. The results may not be generalizable, although the demographics and clinical characteristics of the patients studied appear fairly representative, and the management was similarly within the standard of care. The study population was small because acute type A hematomas are a relatively rare phenomenon. A large series would likely necessitate a multi-institutional study design. Patients were not randomized to a treatment strategy, and it is possible that surgeons chose patients with favorable characteristics for delayed surgical intervention. However, these findings highlight that, with proper patient selection, acceptable outcomes can be achieved with delayed management.

Although evidence is building that not every type A IMH requires emergent operative intervention, the optimal timing of surgery remains uncertain [Leshnower 2018]. IMHs do have the possibility of progressing into frank dissections, and groups have demonstrated that good outcomes can be achieved with early intervention [Matsushita 2016; Roselli 2016]. However, the likelihood and risk factors for this progression are unclear and warrant further investigation [Xie 2018]. In both our series and the International Registry of Aortic Dissection (IRAD), there are reports of patients with IMH who are successfully managed medically without surgery [Evangelista 2005]. As endovascular options for the proximal thoracic aorta continue to develop and improve, there has been interest in applying them to type A IMH, but currently, the evidence for this approach remains lacking [Sundt 2007].

Although other groups have demonstrated favorable results with delayed operative and sometimes medical management of IMH [Ferrera 2017], our study excluded patients who presented with radiographic evidence of both intramural hematoma and dissection to distinguish these 2 pathological processes. We believe it is important to view IMH and dissection

separately in analyses of outcomes, given the potential difference in etiology between the 2 diseases. Although an IMH likely involves disruption of the vasa vasorum, because there is no injury to the intima, the theoretical risk of progression may be lower because the site of disease is not directly exposed to the shear stress of aortic blood flow [Sundt 2007].

Type A intramural hematoma may represent a different clinical and pathological entity than other acute aortic syndromes of the ascending aorta and aortic root, resulting in a diminished risk of immediate life-threatening complications. Delayed operative intervention strategy may be beneficial, especially in patients who are poor surgical candidates.

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