Preoperative characteristics and surgical outcomes of acute intramural hematoma involving the ascending aorta: A propensity score–matched analysis

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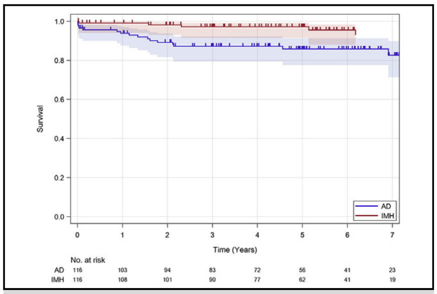
ABSTRACT

Objective: We aimed to evaluate the preoperative characteristics and surgical outcomes of acute type A intramural hematoma.

Methods: Between January 2000 and June 2011, 460 consecutive patients underwent emergency open surgery for type A acute aortic syndrome at Sakakibara Heart Institute. Among these patients, 121 had intramural hematoma and 339 had typical aortic dissection. We compared the clinical characteristics and surgical outcomes using propensity score matching.

Results: In all patients, the intramural hematoma group had an older age (69.2 ± 10.4 years vs 63.4 ± 13.5 years; $P < .001$), included a higher ratio of female patients (56.2% vs 44.0%, $P = .020$), and more frequently had hypertension (94.2% vs 83.5%, $P = .005$), hyperlipidemia (25.6% vs 12.7%, $P < .001$), and cardiac tamponade (33.1% vs 18.3%, $P < .001$) than patients with aortic dissection. Cerebral malperfusion (0.8% vs 5.3%, $P = .033$), myocardial malperfusion (0.8% vs 8.2%, $P = .002$), lower limb malperfusion (1.7% vs 7.9%, $P = .015$), Marfan syndrome (0% vs 3.5%, $P = .042$), and aortic valve insufficiency (2.5% vs 15.0%, $P < .001$) were less frequently observed in the intramural hematoma group than in the aortic dissection group. After propensity score matching, 116 matched pairs were created. In the matched analysis, operative mortality was 0.9% in the intramural hematoma group (1/116) and 3.4% in the aortic dissection group (4/116, $P = .179$). The intramural hematoma group demonstrated higher actuarial 1- and 5-year survivals than the aortic dissection group (99.1 % vs 93.6% and 97.3% vs 85.9%, respectively, $P = .006$). In the multivariate analysis, intramural hematoma was shown to be associated with lower midterm mortality (hazard ratio, 0.316; 95% confidence interval, 0.102-0.974; $P = .045$).

Conclusions: Patients with intramural hematoma have different preoperative clinical characteristics compared with patients with aortic dissection. Emergency open surgery for type A intramural hematoma demonstrated low operative mortality and excellent 5-year survival. (J Thorac Cardiovasc Surg 2016;151:351-8)



Kaplan–Meier survival analysis for all causes of death with 95% confidence limits in matched patients.

Central Message

Clinical characteristics of IMH were different from those of AD. Emergency surgery for IMH showed excellent results.

Perspective

The optimal initial treatment strategy for IMH remains controversial. Emergency open surgery for acute type A IMH can be performed using the same operative strategy and procedure as those for patients with AD. Some patients require late reoperations for the aorta related to IMH. Patients with IMH should be followed up carefully, similar to patients with AD.

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Acute intramural hematoma (IMH) is a life-threatening disease requiring emergency treatment. This emergency is similar to, but pathologically different from, acute aortic dissection (AD). Two different pathophysiologic processes have been suggested to lead to the occurrence of IMH. One cause is spontaneous rupture of the aortic vasa vasorum, leading to a hematoma in the media of the aortic wall without intimal disruption.[1] The other process is an atherosclerotic ulcer, which penetrates into the internal media of the aortic wall.[2] Uchida and colleagues[3] analyzed the

Abbreviations and Acronyms
AD = aortic dissection
CI = confidence interval
CT = computed tomography
HR = hazard ratio
IMH = intramural hematoma
TAR = total arch replacement

clinical, surgical, and histopathologic characteristics of IMH and concluded that patients with IMH have a high risk of adventitial rupture. Although the optimal initial treatment strategy for IMH remains controversial, early surgery for all patients with type A IMH has been recommended because of their poor prognosis with medical treatment.[3,4]

Several investigators have analyzed the surgical outcomes in patients with type A IMH and concluded that patients with IMH have more favorable results compared with those with AD.[5,6] However, there are few reports regarding late operative outcomes in patients with IMH.[7,8] We aimed to compare preoperative characteristics and short-term and midterm outcomes after emergency surgery between patients with IMH and patients with AD.

PATIENTS AND METHODS

Patient Population

This study was approved by the institutional review board, and a waiver of informed consent was obtained. Between January 2000 and June 2011, 121 patients with IMH and 339 patients with AD underwent emergency open surgery at Sakakibara Heart Institute. All of these patients had emergency surgery within 24 hours after admission to our hospital. The median follow-up was 51 months, ranging from 1 to 114 months.

The most common initial symptoms were chest, abdominal, or back pain, and there were some patients with a loss of consciousness in the both groups. The diagnosis was made with contrast computed tomography (CT) in all patients. IMH was defined as a thickened aortic wall caused by intramural hemorrhage, with a crescent or circular high attenuation area along the aortic wall without enhancement on contrast-enhanced CT, indicating noncommunication with the aortic lumen. IMH has been defined by the absence of an intimal tear.[5] In this study, however, we included AD with a totally thrombosed false lumen in the IMH group because it is difficult to confirm the absence of intimal tears in the entire aorta without complete aortography or autopsy.[6,8,9] Our indication of surgery for IMH included cardiac tamponade, an ascending aorta 45 mm or greater, and thickness of a hematoma in the false lumen greater than 7 mm.

Data Collection and Definitions

Perioperative data were collected from patients' medical records. Cardiac tamponade was defined as a cardiogenic shock with a systolic blood pressure of 90 mm Hg or less, associated with pericardial effusion, which was confirmed by CT or echocardiography. Cerebral malperfusion was defined as newly developed neurologic deficits and the presence of false lumen in any cerebral branch arteries on the CT images. Myocardial malperfusion was defined as electrocardiogram change indicating myocardial ischemia and elevated myocardial enzymes. Lower limb malperfusion was defined as newly developed lower limb pain, coldness, paralysis/parenthesis, or loss of pulses. Mesenteric malperfusion was diagnosed by CT showing impaired flow in the mesenteric artery or celiac artery and abdominal findings, such as distension, pain, and tenderness. Stroke was defined as a central neurologic deficit persisting for more than 72 hours after surgery. All strokes were confirmed by CT or magnetic resonance imaging. Respiratory failure was defined as a requirement for mechanical ventilation for more than 48 hours postoperatively. Operative mortality was defined as any death within 30 days after surgery or before discharge. IMH- or AD-related events were defined as follows: new IMH or dissection, need for further surgical treatment, aortic rupture, and sudden unexplained death. IMH- or AD-related deaths were defined as follows: death from aortic rupture, sudden unexplained death, and death after further surgical treatment. Our indications of reoperation for the aorta related to IMH or AD were as follows: rupture or impending rupture of the aorta, dilatation of the aorta 55 mm or greater, rapid dilatation of the aorta (>10 mm/y), graft infection, and severe aortic valve insufficiency.

Operative Strategy and Procedure

All of the operations were performed through a median sternotomy. The initial arterial cannula was mostly placed in the femoral artery. The left ventricular apex or axillary artery was cannulated if the femoral artery was unavailable. Femoral arterial cannulation was avoided when distal aortic aneurysm, iliofemoral disease, femoral artery dissection, or limb ischemia was present. Our strategy of selection of the cannulation site has been described.[10] In all patients, a combination of antegrade and retrograde cardioplegia was used. The patient was cooled down to 25°C for circulatory arrest. A single-branched prosthesis was used in ascending aortic or hemiarch replacement, and a 4-branched prosthesis was used in total arch replacement (TAR). Our indication of TAR was aortic arch dilatation (≥45 mm), a penetrating atherosclerotic ulcer in the aortic arch, and an intimal tear located in the distal aortic arch or the greater curvature of the aortic arch.

The proximal side of the aorta was repaired with gelatin resorcinol formaldehyde glue and double strips (a vascular graft strip or Teflon felt strip inside and a Teflon felt strip outside) at the level of the sinotubular junction. The distal side of the aorta was repaired with double Teflon felt strips in ascending aortic or hemiarch replacement. A folded elephant trunk graft was inserted into the distal aorta, reinforced with an outer Teflon felt strip, and anastomosed to the aorta with a running suture in the TAR.

In ascending aortic or hemiarch replacement, distal anastomosis was performed under hypothermic circulatory arrest with retrograde cerebral perfusion from the superior vena cava. After distal anastomosis, whole body circulation was resumed through the branch of the prosthesis and the patient was fully rewarmed up to 35°C. Proximal anastomosis was performed during rewarming.

In TAR, we used the arch-first technique with retrograde cerebral perfusion between January 2000 and August 2006. Subsequently, we introduced antegrade selective cerebral perfusion and separate lower-body perfusion in 2006.[11] Since 2006, distal anastomosis has been performed using the elephant trunk technique under hypothermic circulatory arrest. We used selective antegrade cerebral perfusion and inserted balloon catheters into 3 cerebral branches. After distal anastomosis, lower body circulation was resumed through a cannula that was placed in the common femoral artery with balloon occlusion of the elephant trunk, and the patient was rewarmed up to 30°C. Cerebral branches were separately anastomosed to the branches of the prosthesis. After reconstructing cerebral branches, whole body circulation was resumed through the fourth branch of the prosthesis and the patient was rewarmed up to 35°C. Proximal anastomosis was performed during rewarming. TAR using the stepwise distal anastomosis technique, selective antegrade cerebral perfusion, and separate lower body perfusion has been reported in detail by Matsuyama and colleagues.[11]

Statistical Analysis

Summary statistics were performed using frequencies and proportions for categoric data, and mean ± standard deviation or median if appropriate for continuous variables. Univariate analyses were carried out using the