Transfer of Patients With Suspected Acute Aortic Syndrome

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Patients with acute aortic syndrome (AAS) often require emergent transfer for definitive therapy. The aim of this study was to evaluate the safety of transfer and the ability to optimize hemodynamics in subjects with AAS transported by an aortic network. A total of 263 consecutive patients with suspected AAS transferred to a coronary care unit from March 2010 to June 2012 were included. Transfers were accomplished by the institutional critical care transfer system using ground ambulance (n = 47), helicopter (n = 196), or fixed-wing jet (n = 20) from referring centers directly to the coronary care unit, bypassing the emergency department. The transfer mortality rate was 0%, and the in-hospital mortality rate was 9% (n = 23). Initial systolic blood pressure and heart rate at the time of arrival of the transfer team to the referring hospital were compared with those on arrival to the coronary care unit. The median transfer distance was 66 km (interquartile range 24 to 119), and the median transfer time was 87 minutes (interquartile range 67 to 114). The transfer team achieved significant reductions in systolic blood pressure (from 142 ± 29 to 132 ± 23 mm Hg) (mean difference in systolic blood pressure 10 mm Hg, 95% confidence interval 7 to 14, p <0.0001) and heart rate (from 78 ± 16 to 75 ± 16 beats/min) (mean difference in heart rate 3 beats/min, 95% confidence interval 1 to 4, p <0.0001). In conclusion, these results indicate that patients with AAS can be safely transferred to specialized centers for definitive treatment, and a well-trained critical care transfer team can actively continue to optimize medical management during transit. © 2013 Elsevier Inc. All rights reserved. **(Am J Cardiol 2013;112:430−435)**

Acute aortic syndrome (AAS) is a life-threatening medical emergency. Diagnostic confirmation requires imaging using computed tomography, transesophageal echocardiography, or magnetic resonance imaging, because clinical signs and symptoms alone are unreliable.[1−5] Treatment often requires urgent open surgical repair or an endovascular procedure.[6−15] Despite significant advances in surgical techniques and expertise, morbidity and mortality remain high, especially within the first 24 hours.[14,16] Current guidelines recommend early initiation of medical therapy to decrease aortic wall stress by controlling heart rate (HR) and blood pressure (BP).[17] Importantly, most patients present to community hospitals and need to be transferred to specialized centers with expertise to definitively manage these patients. Therefore, anticipating delays in diagnosis and patient transfer, it is imperative that medical management aiming at optimizing HR and BP be initiated immediately on suspicion of AAS and continued until definitive management. As a quality initiative evaluation of our acute aortic network, we sought to analyze our team's performance in safely transporting and advancing care for patients with AAS during the transfer interval.

Methods

An institutional aortic network was created in 2008 to standardize the care of patients with suspected AAS from the time of their presentation to regional centers (site of initial diagnosis) until definitive treatment in our coronary care unit (CCU). The network can be activated by a single phone call to our institution's acute care transfer line. This line is dedicated to time-sensitive emergencies and is also used for activation of our acute ST-segment elevation myocardial infarction (STEMI) and acute stroke networks. On activation of the network, a transfer team is immediately dispatched to the referring facility, and the CCU is alerted. The transport team consists of critical care nurse practitioners who are trained to perform all emergency procedures and follow evidence-based protocols to manage medical emergencies during the transfer process. The team receives 24-hour support from a CCU cardiologist through a direct phone link. While en route, the CCU physicians and the transfer team can also communicate with physicians at the referring facility to obtain information about the patient in anticipation of arrival. To expedite handover time, the referring centers are also instructed to keep imaging studies available on digital media to be transferred along with the patient and are updated regularly on anticipated arrival time of the transfer team. The CCU physicians in turn alert the vascular and cardiothoracic surgeons to initiate immediate consultation on patient arrival.

Upon arrival to the referring center, the transfer team's goal is to mimic downstream care in the receiving unit (CCU) using specific guidelines. For patients with suspected AAS, initial goals are to achieve and maintain an HR of

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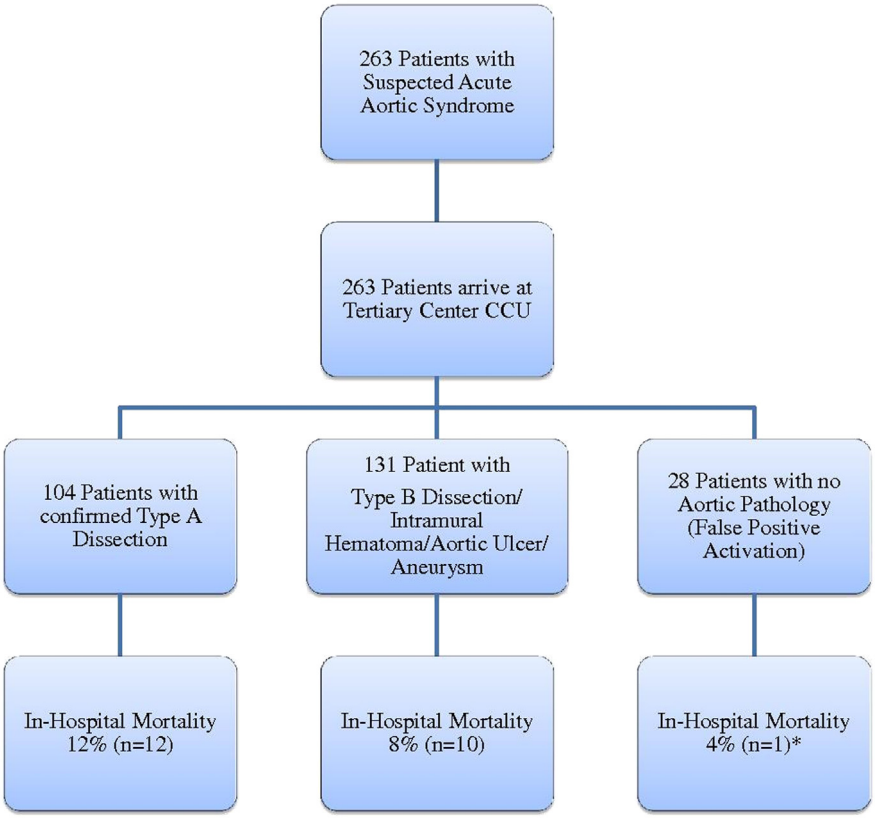

Figure 1. Outcomes in patients transferred with suspected AAS. At the top are all patients with AAS at referral centers transferred to the tertiary center. Outcomes specific to definitive diagnoses (Stanford type A or B dissection, aortic aneurysm, aortic ulcer, intramural hematoma, and false-positive activation) are presented lower in the hierarchy chart. *Aortic dissection was ruled out, but the patient was diagnosed with severe mesenteric ischemia and died from ischemic bowel and sepsis.

60 beats/min and a systolic BP of 100 to 120 mm Hg. Medical therapy if started at the referral center is continued and further optimized to achieve the desired therapeutic goals. Intravenous access is obtained in patients without access before transfer. In addition, the team attempts to place arterial line catheters in all patients for invasive hemodynamic monitoring. Once patients reach the CCU, they are immediately evaluated by the cardiologist in consultation with thoracic and/or vascular surgeons; imaging studies are reviewed and additional imaging performed if indicated. Urgent bedside echocardiography is performed on all patients. Subsequently, patients are emergently triaged toward definitive management, either surgery (open or endovascular) or continued medical management alone.

From March 2010 to June 2012, 263 consecutive patients were transferred to our CCU from regional health care facilities with suspected or confirmed diagnoses of AAS. The study was approved by the Cleveland Clinic institutional review board. All transfer data were prospectively recorded, starting from telephone activation of the AAS network system and continuing until arrival at the CCU. Presenting signs and symptoms and diagnostic studies performed were obtained for all patients. Total transfer time (time from activation of the network to arrival at the CCU), handover times (time from transfer team arrival at the outside hospital to time the patient left the outside hospital), and inward transfer times were obtained. Descriptive information regarding patient care and medical management was recorded. BP and HR as noted on patient handover at the referring facility were compared with those captured on arrival at the CCU. Patients were retrospectively assessed for significant changes in either BP or HR during transfer. A significant change in BP was defined as a change in systolic BP of $\geq$10 mm Hg. Similarly, a change of $\geq$10 beats/min in HR within the transfer period was considered significant. Patients who were noted to be hypotensive (systolic BP $<$90 mm Hg) at the time of handover to the transfer team ($n = 9$) were excluded from our analysis for comparing hemodynamics, because there was no scope for reduction in BP in these patients.

Continuous variables are presented as mean $\pm$ SD or median (interquartile range [IQR]) and categorical variables as percentages affected. Continuous data (comparison of hemodynamics before and after transfer) were analyzed using nonparametric tests (Wilcoxon's matched-pairs signed-rank tests) after determination of lack of normal distribution using D'Agostino and Pearson omnibus normality tests. Frequency histograms were constructed to compare the percentages of patients with BPs and HRs within specific parameters before and after transfer. All tests were 2 tailed, and p values <0.05 were considered significant. Statistical calculations were done using SAS version 9.2 (SAS Institute Inc., Cary, North Carolina).