Changes in operative strategy for patients enrolled in the International Registry of Acute Aortic Dissection interventional cohort program

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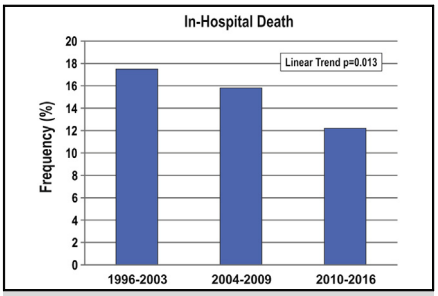
ABSTRACT

Objective: Advancements in cardiothoracic surgery prompted investigation into changes in operative management for acute type A aortic dissections over time.

Methods: One thousand seven hundred thirty-two patients undergoing surgery for type A aortic dissection were identified from the International Registry of Acute Aortic Dissection Interventional Cohort Database. Patients were divided into time tertiles (T) (T1: 1996-2003, T2: 2004-2010, and T3: 2011-2016).

Results: Frequency of valve sparing procures increased (T1: 3.9%, T2: 18.6%, and T3: 26.7%; trend $P < .001$). Biologic valves were increasingly utilized (T1: 35.6%, T2; 40.6%, and T3: 52.0%; trend $P = .009$), whereas mechanical valve use decreased (T1: 57.6%, T2: 58.0%, and T3: 45.4%; trend $P = .027$) for aortic valve replacement. Adjunctive cerebral perfusion use increased (T1: 67.1%, T2: 89.5%, and T3: 84.8%; trend $P < .001$), with increase in antegrade cerebral techniques (T1: 55.9%, T2: 58.8%, and T3: 66.1%; trend $P = .005$) and hypothermic circulatory arrest (T1: 80.1%, T2: 85.9%, and T3: 86.8%; trend $P = .030$). Arterial perfusion through axillary cannulation increased (T1: 18.0%, T2: 33.2%, and T3: 55.7%), whereas perfusion via a femoral approach diminished (T1: 76.0%, T2: 53.3%, and T3: 30.1%) (both P values $< .001$). Hemiarch replacement was utilized more frequently (T1: 27.0%, T2: 63.3%, and T3: 51.7%; trend $P = .001$) and partial arch was utilized less frequently (T1: 20.7%, T2: 12.0%, and T3: 8.4%; trend $P < .001$), whereas complete arch replacement was used similarly ($P = .131$). In-hospital mortality significantly decreased (T1: 17.5%, T2: 15.8%, and T3: 12.2%; trend $P = .017$).



In-hospital mortality rates dropped significantly over the course of 20 years.

Central Message

Operative strategy in the management of type A aortic dissection changed and in-hospital mortality dropped significantly over a 20-year timespan.

Perspective Statement

Over 20 years an increase was seen in the use of valve-sparing procedures, bioprosthetic aortic valve substitutes, antegrade cerebral perfusion strategies, and hypothermic circulatory arrest. With ever-evolving techniques, outcomes of surgical management of type A aortic dissection will continue to improve.

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This research was supported by W.L. Gore & Associates, Inc; Medtronic; the Varbedian Aortic Research Fund, the Hewlett Foundation; the Mardigian Foundation; UM Faculty Group Practice; Terumo; and Ann and Bob Aikens. Dr H.J.P. was generously supported by the David Hamilton Fund and the Phil Jenkins Breakthrough Fund in Cardiac Surgery at the University of Michigan Frankel Cardiovascular Center.

Dr H.J.P. has received consulting fees from Medtronic, Terumo, and W.L. Gore & Associates, Inc. Dr S.T. is a consultant for Medtronic and W.L. Gore & Associates, Inc. Dr K.A.E. has a scientific grant from W.L. Gore & Associates, Inc, and Medtronic. Dr T.M.S. is a consultant for Thrasos Therapeutics. Dr H.M. is a consultant for Elixir Medical. Dr N.D.D. is a consultant for W.L. Gore & Associates, Inc; Medtronic; and St Jude and has research grants from Cook Medical, Edwards Lifesciences, and St Jude Medical. Dr J.B. is a consultant for St Jude Medical and has research grants from Edwards Lifesciences; Medtronic; Vascutek; and W.L. Gore & Associates, Inc.

N.P. and S.T. contributed equally to this article.

Read at The American Association for Thoracic Surgery Aortic Symposium 2016, New York, New York, May 12-13, 2016.

Received for publication May 18, 2016; revisions received Dec 12, 2016; accepted for publication Dec 28, 2016.

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0022-5223/$36.00

http://dx.doi.org/10.1016/j.jtcvs.2016.12.029

Abbreviations and Acronyms
CABG = coronary artery bypass graft
HCA = hypothermic circulatory arrest
IVC = interventional cohort
IRAD = International Registry of Acute Aortic Dissection
TAAD = type A aortic dissection

Conclusions: There have been significant changes in operative strategy over time in the management of type A aortic dissection, with more frequent use of valve-sparing procedures, bioprosthetic aortic valve substitutes, antegrade cerebral perfusion strategies, and hypothermic circulatory arrest. Most importantly, a significant decrease of in-hospital mortality was observed during the 20-year timespan. (J Thorac Cardiovasc Surg 2017;■:1-6)

Acute aortic dissection is a lethal cardiovascular event, with an early mortality rate of up to 1% to 2% per hour if left untreated.[1-3] For type A aortic dissection (TAAD), urgent surgery is indicated, with lower mortality than either medical or endovascular treatment.[1,4,5] During the past several decades, cardiovascular surgery has evolved, with many advances in pharmaceuticals, devices, and procedures.[6] The Interventional Cohort database (IVC) was established in 2006 as a subcohort of the International Registry of Acute Aortic Dissections (IRAD) database. Patients were included prospectively from 2006 to the present and retrospectively before 2006. The IRAD-IVC database was initiated to provide more detailed insight into surgical techniques and procedures for aortic dissection. We queried this database to investigate trends in operative management from 1996 to 2016.

METHODS

Patient Selection and Data Collection

IRAD is an observational data registry whose retrospective data collection methods have been detailed previously.[1] Within IRAD, a subset of patients from participating sites that undergoes either surgical or endovascular intervention is included in the IVC Program. Details from the procedures performed at baseline are recorded on a separate, standardized form and entered into an online database managed by the IRAD coordinating center at the University of Michigan. Data are reviewed for face validity and completeness. Institutional review board approval for this study was obtained at each participating institution.

From all patients enrolled in IRAD-IVC, only TAAD patients undergoing operative repair or surgical procedure as part of a hybrid procedure were included, whereas patients undergoing type B aortic dissection and those with only endovascular or medical management were excluded. Patients were split into 3 equal groups based on time of intervention tertile (T) (T1: 1996-2003, T2: 2004-2010, and T3: 2011-2016). Arch interventions were defined. Hemiarch arch replacement = only the underside of the arch replaced. Partial arch replacement = only the proximal part of the arch was replaced with reimplantation of at least 1 of the brachiocephalic vessels. Complete arch replacement = complete replacement of the arch of the aorta.

Statistical Analysis

Analysis of variance was performed between groups. Pairwise comparison was done to assess significance between groups, with Student *t* test and Fischer exact test (or nonparametric tests) used where appropriate. Trend *P* values were calculated using linear by linear association (Mantel-Haenszel test of trend). To determine independent associations, binary logistic regression analysis was used. Candidate variables with a significance <0.20 during univariate analysis were introduced to the model after considering clinical relevance. SPSS version 21.0 software (IBM-SPSS Inc, Armonk, NY) was used to conduct the analyses.

Furthermore, we applied a mixed model approach, containing both fixed and random effects. A mixed model is particularly useful for clusters of related statistical units. This approach was used to ensure that the effect of hospitals joining the registry in the later years did not create an unintended bias.

RESULTS

Demographic Characteristics and In-Hospital Outcomes

Mean age was different between the groups ($P = .011$). There were no gender-related differences. In-hospital mortality decreased over time (T1: 17.5%, T2: 15.8%, and T3: 12.2%; trend $P = .017$) (Table 1).

Aortic Valve and Root Management

When aortic valve replacement was required, use of biological valves increased over time (T1: 35.6%, T2: 40.6%, and T3: 52.0%; trend $P = .009$), with a corresponding decrease in mechanical valve implantation (T1: 57.6%, T2: 58.0%, and T3: 45.4%; trend $P = .027$). All results are shown in Table 2. Use of valve sparing procedures, including Yacoub remodeling or David reimplantation, increased over time (T1: 3.9%, T2: 18.6%, and T3: 26.7%; trend $P < .001$) (Figure 1), with no difference in use of remodeling or reimplantation surgical techniques (trend $P = .216$). All results are shown in Table 2.

Coronary ostium repair was used more often in the later years (T1: 4.3%, T2: 11.9%, and T3: 15.0%; trend $P < .001$), whereas the frequency of concomitant coronary artery bypass graft (CABG) procedures was similar over time.

Ascending Aorta Management

An open distal anastomosis was used most often across all time periods. Supracoronary ascending replacement changed over time (T1: 76.4%, T2: 72.5%, and T3: 81.7%; trend $P = .004$). The use of surgical glue declined over time (T1: 74.4%, T2: 68.4%, and T3: 45.0%; trend $P < .001$), as did the use of polytetrafluoroethylene felt (T1: 89.3%, T2: 85.3%, and T3: 76.7%; trend $P < .001$). Right axillary artery cannulation for inflow was used more often over time (T1: 18.0%, T2: 33.2%, and