Survival and quality of life after repair of acute type A aortic dissection in patients aged 75 years and older justify intervention

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Received 13 September 2005; received in revised form 7 December 2005; accepted 13 December 2005

Abstract

Objective: Controversy still exists about averting expenditure of health care resources on the growing elderly population. This study evaluates clinical outcome of patients aged 75 years and older operated upon for acute type A aortic dissection.

Methods: Between January 1990 and April 2004, of 247 patients undergoing emergency operation for acute type A aortic dissection at our Institution, 40 patients (16%) were aged 75 years and older (mean 78±3 years, range 75–88 years) and represent the study population. On admission, 9 (22.5%) had cardiogenic shock/hypotension, 20 (50%) cardiac tamponade, 14 (35%) kidney failure, 11 (27.5%) limb ischemia, 3 (7.5%) neurologic deficit, and 1 (2.5%) myocardial ischemia. Surgical procedures included isolated replacement of the ascending aorta in 34 patients (85%), associated with total root replacement in 5 (12.5%), and with aortic valve replacement in 1 (2.5%). Eleven patients (27.5%) underwent aortic arch replacement (hemiarch: n = 8, 20%; total arch: n = 3, 7.5%).

Results: In-hospital mortality was 30% (12 patients). Mortality tended to be higher (8/21, 38% vs 4/19, 21%; p = NS) for patients presenting with any one of the following complications: tamponade, shock, brain and/or myocardial, renal, limb malperfusion. Actuarial survival at 1, 5, and 7 years was 93±5%, 80±8%, and 80±8%, respectively, and freedom from reoperation 97±2%, 97±2%, and 97±2%, respectively. Actuarial event-free rates were 94±3%, 90±5%, and 90±5%. Seventy-four percent of survivors are in NYHA FC I, and quality of life test (RAND SF-36) revealed a generalized perception of independency and well-being, comparable to an age-matched population.

Conclusions: Overall results for emergency repair of acute type A aortic dissection in the elderly justify intervention, particularly in uncomplicated cases. Survivors show functional status and quality of life similar to contemporary individuals.

Keywords: Aortic dissection; Mortality; Elderly; Quality of life

1. Introduction

Acute type A aortic dissection (AAD) is a life-threatening emergency that carries a high mortality rate without surgical treatment [1,2]. Surgical mortality has been estimated to range from 9% to 30%, and survival rates of 51–82% at 5 years have been reported [3–9]. Previous studies have also shown age to be an independent predictor of mortality in patients with AAD undergoing surgical treatment [2,3,10], with reported in-hospital mortality as high as 84% in patients over 80 years of age [11]. With the general increase in human lifespan, an increasing number of elderly patients are being referred for aortic operation. Definition of clinical outcome in this patient cohort is, thus, crucial to establish appropriateness of averting expenditure of health care resources to this subgroup of patients [11–13].

This study retrospectively evaluated the clinical outcome of patients aged 75 years and older operated upon for AAD, in an attempt to critically review surgical indications in an era when limited resources strongly require cost-effective strategies. Quality of life of survivors based on patients’ own perceptions of their health (RAND36-SF) was also evaluated.

The study was conducted in a tertiary university hospital with 25 years experience in aortic dissection.

2. Materials and methods

Between January 1990 and April 2004, 247 patients underwent emergency operation for acute type A aortic...
dissection at our Institution. Among these, 40 unselected consecutive patients (16%) [21 males (52.5%)] were aged 75 years and older [mean 78 ± 3.2 years, range 75–88 years, median 77 years, 95% confidence limit (95% CL) 77.2–79.3 years] and represent the study population.

The present study was triggered by the evidence that the factor age represented a predictor of mortality both at univariate and multivariate analysis when testing the entire cohort of patients (N = 247) (OR 1.63 years, 95% CL 1.44–1.73 years, p < 0.049 and OR 1.55 years, 95% CL 1.49–1.64 years, p < 0.05, respectively) [14]. Since the factor age increased the probability of death but without the evidence of a specific cut-off, this retrospective analysis was undertaken in patients aged 75 years and older according to previously reported experiences to facilitate comparison.

Type A aortic dissection was defined as involvement of the ascending aorta according to previously published criteria. The dissection was considered acute if symptoms occurred within 14 days. Twenty-five patients (62.5%, 95% CL 45.8–77.2%) had past medical history of hypertension, one presented several phenotypic manifestations (tall stature, pectus excavatum) and clinical features (mitral valve prolapse, dilated mitral annulus, myopia) of Marfan syndrome (2.5%, 95% CL 0.06–13.1%), and one had bicuspid aortic valve (2.5%, 95% CL 0.06–13.1%). Two patients (5%, 95% CL 0.6–16.9%) had undergone previous cardiac surgery (aortic valve replacement = 1, mitral valve replacement = 1). On admission, five patients (12.5%, 95% CL 4.1–26.8%) had aortic valve regurgitation (mild = 1, moderate = 1, severe = 3). Thirty-one patients (77.5%) were admitted within 48 h since onset of symptoms.

Significant clinical data on admission are listed in Table 1. Age distribution of patients is reported in Fig. 1.

Diagnosis of AAD was usually established by computed tomography scan, magnetic resonance imaging and/or transesophageal echocardiogram. Since 1995, if diagnostic information was regarded as complete at admittance, patients were transferred to the operating room for immediate surgery without any delay. Intra-operative control of aortic valve function and additional informations were then determined by transesophageal echocardiography [15,16].

2.1. Operative technique

All patients underwent median sternotomy with total cardiopulmonary bypass, with the femoral artery being used for arterial pump inflow in almost all cases [17]. Myocardial protection was achieved with repetitive doses of either crystalloid or blood cardioplegia (since 1995) delivered antegrade, or antegrade and retrograde. Topical cooling was routinely utilized. Patients were routinely cooled to a rectal temperature of 18 °C, having the head placed in a tub for additional topical brain protection with ice. Inspection and procedures on the aortic arch were performed with a similar approach under deep hypothermia and circulatory arrest. Since 2001, to enhance cerebral protection, antegrade cerebral perfusion was established anytime the period under deep hypothermia and circulatory arrest to perform the chosen procedure was expected to last arbitrarily over 20 min. Antegrade cerebral perfusion was established by direct endoluminal cannulation of the innominate and left carotid arteries.

After careful inspection, the decision on reimplantation of the aortic valve, composite replacement or supracommissural replacement depended on individual morphology as well as on the extension of the dissection.

In 37 patients (92%), the main intimal tear was located in the ascending aorta within 5 cm above the sino-tubular junction. It was in the transverse arch in the remaining three cases. Eleven patients (27%) had preexisting dilatation of the ascending aorta (transverse diameter above the sino-tubular junction > 5 cm). The most recurrent pathologic patterns were consistent with a calcified dissected atherosclerotic aorta with multiple plaques in about one-half of the patients, and a fragile thin-walled dissected aorta in the other.

Operations performed included isolated replacement of the ascending aorta alone (N = 34, 85%, 95% CL 70.1–94.2%), associated with aortic valve replacement (N = 1, 2.5%, 95% CL 0.06–13.1%), and with total root replacement (N = 5, 12.5%, 95% CL 4.1–26.8%). Eleven patients (27.5%, 95% CL 14.6–43.8%) underwent aortic arch replacement (hemiaortic: n = 8, 20%, 95% CL 9.0–35.6%; total arch: n = 3, 7.5%, 95% CL 1.5–20.3%). Two patients (5%, 95% CL 4.1–26.8%) underwent replacement of the proximal segment of the innominate artery. One patient underwent associated myocardial revascularization to treat associated retrograde dissection of the right coronary artery ostium deemed not amenable of repair by conservative approach. None of the patients underwent a valve-sparing procedure.

Mean cardiopulmonary by-pass time was 183 ± 39 min (median 179 min, 95% CL 172–202 min) and mean aortic X-
clamp time 92 ± 37 min (median 90 min, 95% CL 81—102 min). Deep hypothermic circulatory arrest was utilized in 31 patients (77.5%, 95% CL 61.5—89.1%; mean time 29.5 ± 23.9 min, median 25 min, 95% CL 21—37 min) and cold (15 °C) antegrade cerebral perfusion in 4 (10%). Retrograde cerebral perfusion was rarely utilized (two cases).

2.2. Clinical and laboratory follow-up

Follow-up was 100% complete up to June 30, 2004. All clinical data were obtained by retrospective review of hospital records. Several variables were recorded for analysis, including date of surgery, demographics (age, sex), etiological (family history, Marfan, hypertension, bicuspid aortic valve, diabetes, obesity, smoke, prior cardiac surgery), clinical (onset of pain, aortic regurgitation, cardiac tamponade, myocardial ischemia, hypotension, neurological deficit including paraplegia, pulse deficit, mesenteric ischemia, acute renal failure, limb ischemia), surgical (anatomy, myocardial protection, CPB time, hypothermic circulatory arrest time, cerebral protection technique, perfusion strategy, type of procedure), and post-operative variables (blood loss for first 24 h, reexploration for bleeding, transfusions, heart failure requiring inotropes, peri-operative MI, respiratory failure, ARDS, mechanical ventilation time, tracheostomy, renal failure requiring dialysis, acute abdominal ischemia, hepatic insufficiency, new neu rologic event, limb ischemia) to identify predictors of in-hospital death.

Patients were followed up directly in our outpatient clinic, mailed questionnaires, or contacted directly by telephone. Data, including physical examination, laboratory tests, electrocardiography, and echocardiography were collected at regular intervals. The RAND SF-36 Item Health Survey 1.0 was also administered to assess quality of life in survivors and assessed by specialized personnel. The well validated and widely used test examines eight general health concepts: physical functioning, bodily pain, role limitation because of physical health problems, role limitation because of personal or emotional problems, emotional well-being, social functioning, energy or fatigue, and general health perceptions [12,18,19].

2.3. Data definition and statistical analysis

We defined operative mortality as all deaths occurring during hospital admission or within 30 days of hospital discharge. Morbidity was defined as the presence of any one of the following complications: permanent stroke, renal dysfunction, or renal failure requiring dialysis, prolonged ventilation (>48 h), reoperation for bleeding or deep sternal wound infection. For the purpose of this analysis, we used standard definitions of risk factors as provided in the STS database.

All continuous variables are presented as mean ± standard deviation, median, and confidence limits 95%. Basic methods of univariate analysis included the \( \chi^2 \) and Student’s \( t \)-test. Actuarial estimates of morbidity events were calculated by the Kaplan–Meier survival analysis method. The logistic regression modeling was used to identify the variables associated with changes in mortality rate. Analysis (including univariate and multivariate testing) was applied to all the above-listed variables. Significance was inferred at a probability value \(< 0.05\).
ascending aorta and reconstruction of the aortic root by Teflon felt and French glue, associated with re-suspension of the aortic valve commissures. After regular post-operative course he was readmitted 3 months later with congestive heart failure due to acute aortic regurgitation, and underwent composite bio-valved conduit replacement of his aortic root (modified Bentall procedure). He made an uneventful recovery. Intra-operative findings showed re-dissection of the aortic root with diffuse areas of tissue necrosis.

For discharged patients, actuarial survival at 1, 5, and 7 years was 93 ± 5%, 80 ± 8%, and 80 ± 8%, respectively, and freedom from reoperation 97 ± 2%, 97 ± 2%, and 97 ± 2%, respectively. Actuarial event-free survival were 94 ± 3%, 90 ± 5%, and 90 ± 5% (N = 3, type II neurologic event = 1, ARF = 1, acute heart failure with aortic valve regurgitation = 1) (Fig. 3).

Of the 19 long-term survivors (68% of discharged patients, 95% CL 47.6–84.1%), 14 (74%, 95% CL 48.7–90.8%) are in NYHA functional class I, 4 (21%, 95% CL 6.0–45.5%) in II, and 1 in III (5%, 95% CL 0.1–26.0%).

All long-term survivors were able to participate in the follow-up questionnaire on quality of life assessment by the RAND 36-Item Health Survey 1.0. Mean scores compared with data obtained from the general Italian population [20] are listed in Table 2. Emotional well-being, social functioning, pain score, general health score showed quite rewarding outcomes compared to the sample population represented by contemporary individuals.

4. Discussion

Immediate surgery for repair of acute type A aortic dissection has been recommended to prevent aortic rupture and/or cardiac tamponade, while ensuring normal coronary, cerebral, and visceral circulation [1,3–6].

Despite increasing experience and advances in diagnosis, surgical techniques, myocardial protection, and peri-operative management, past reported in-hospital mortality for repair of acute type A aortic dissection in the elderly has been as high as 83% [11], thus arising concern about the opportunity to avert health care resources to such a demanding cohort of patients. Furthermore, the few existing reports on quality of life after dissection repair for similar patients have shown disappointing outcomes [11,21,22].

With an overall in-hospital mortality of 30%, and 33% for patients aged 80 years or older, our results on 40 unselected consecutive elderly patients well compared with prior clinical series [7,11,23,24]. Indeed, Metha et al. [24] reported an in-hospital mortality rates among elderly patients managed surgically of 42.5% in the age range 75–79 years, of 45.5% in the age range 80–84 years and of 50% for patients aged 85 years or older, while Neri et al. [11] reported a hospital mortality of 83% in octogenarians. Chiappini et al. [23] reported a hospital mortality rate for patients of 70 years of age and older of 17.6%. Among the key factors for their outstanding results, however, the Authors mentioned strict selection of patients. This information raises some concern on how appropriate it might be to compare treated population among centers in the absence of rigid criteria to stratify pre-operative risk factors.

Despite our encouraging results, the observed mortality was still higher when compared to the cohort of patients operated upon below 75 years of age. This might be related to the simply higher prevalence of comorbidity in the elderly which makes of age per se a strong and well recognized independent predictor of mortality [2,3,10,14].

But what does indeed ‘age’ represent? Adopting a less simplistic perspective, several factors beyond comorbid conditions should be independently analyzed in view of their potential role to worse prognosis after onset of AAD in the elderly.

As previously reported, etiology of AAD is different in the elderly with higher prevalence of long-lasting hypertension, atherosclerosis, and prior aortic aneurysm-related dissection, all conditions associated with important systemic organs implications (i.e. coronary, renal, CNS artery involvement) [24]. Moreover, onset of symptoms and symptom modality may be atypical in this age group, thus delaying prompt diagnosis and intervention. Elderly patients seem to incur into more complications while in the twilight zone between event and treatment, mainly related to the frequently

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### Table 2

<table>
<thead>
<tr>
<th>Category of questions</th>
<th>Study group</th>
<th>General (Italian) population (&lt;75 years)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical functioning</td>
<td>48.09 ± 20.27</td>
<td>45.61 ± 35.15</td>
<td>NS</td>
</tr>
<tr>
<td>Role limitations because of physical health</td>
<td>32.07 ± 21.19</td>
<td>45.52 ± 53.11</td>
<td>NS</td>
</tr>
<tr>
<td>Role limitations because of emotional health</td>
<td>50.87 ± 2.34</td>
<td>50.87 ± 54.23</td>
<td>NS</td>
</tr>
<tr>
<td>Energy/fatigue</td>
<td>48.18 ± 8.42</td>
<td>42.80 ± 28.82</td>
<td>NS</td>
</tr>
<tr>
<td>Emotional well-being</td>
<td>57.92 ± 12.56</td>
<td>52.33 ± 29.79</td>
<td>NS</td>
</tr>
<tr>
<td>Social functioning</td>
<td>56.91 ± 3.16</td>
<td>58.29 ± 32.53</td>
<td>NS</td>
</tr>
<tr>
<td>Pain score</td>
<td>55.80 ± 2.5</td>
<td>48.27 ± 36.29</td>
<td>NS</td>
</tr>
<tr>
<td>General health score</td>
<td>51.36 ± 18.56</td>
<td>40.71 ± 28.66</td>
<td>NS</td>
</tr>
</tbody>
</table>
occurring hypotension, particularly deleterious in those with long-lasting hypertensive disease. Medication commonly used to reduce the risk and extension of aortic dissection, such as β-blockers, are utilized less often in the elderly, thus increasing propensity for rupture. Finally, in the absence of clearly defined guidelines to admit an old patient to the surgical pathway, the decision-making process may represent the last stumbling-block against a potentially successful treatment.

Although cardiac tamponade emerged as the only independent predictor of in-hospital mortality in our study group, retrospective analysis of our old patients in view of pre-operative variables (hypotension, myocardial ischemia, acute renal failure, limb ischemia, neurologic deficit, and tamponade), which proved predictive of mortality in the entire series [14], showed a 38% mortality rate for complicated versus 21% for uncomplicated patients, respectively. The fact that an almost double hospital mortality might not reach statistical significance may be due to the small patient sample in the present series.

Interestingly enough, no other variables, including type of procedure and extension of proximal and distal aortic resection were associated with increased in-hospital mortality. Based on these results and in accordance with other authors [25], our current policy is aggressive management of any arch involvement using moderate hypothermic circulatory arrest with selective cerebral antegrade perfusion to enhance brain protection. Retrograde cerebral perfusion or a combination of the two techniques is considered when dealing with a severely atherosclerotic arch to minimize the chance of cannulation origin embolism related to the former technique. In such circumstances, retrograde cerebral perfusion may also offer the advantage to prevent debris from reaching the terminal brain vessels and/or to wash out particulate emboli and metabolites [26].

Our data support the hypothesis that patient clinical conditions on entering the operating room strongly affect in-hospital mortality. Therefore, to effect a significant increase in overall patient salvage rate, expeditious referral and intervention by lowering pre-operative dissection comorbidity might represent a valuable tool to improve results, particularly in the more vulnerable older patient. To this aim, a rapid diagnostic pathway using echocardiography as the main tool, often directly in the operating room to save time, may contribute to the final overall results.

Concern for intra-operative malperfusion syndrome, reported to be as high as 13% [17], has caused surgeons to search for alternative sites of arterial cannulation to provide the best organs perfusion during repair. Beside direct dissected ascending aorta cannulation [9] and transventricular ascending aortic cannulation, these included mainly subclavian or axillary artery cannulation claimed to offer superior brain protection [27]. All these available options showed pro and con and experience usually dictates which technique best applies to the individual patient. In our series, femoral cannulation proved safe, reproducible, and led to appreciable results. None of our adverse outcomes could be retrospectively attributed to an unrecognized malperfusion phenomena.

Although recent major improvements in both initial resuscitation and intensive care treatment have resulted in increased survival of elderly patients with AAD, their clinical course in the present experience required longer stay and expense in terms of human and hospital resources far beyond average. Nevertheless, and apparently in contrast with previously published results [11,21,22], mid-term outcome was rewarding considering the advanced age, with an actuarial survival rate at 5 and 7 years of 80%. More importantly, functional status for survivors was satisfactory and remained stable over time. Finally, results of test for assessment of quality of life revealed a generalized acceptable perception of independency and well-being with an overall score which well compared with the general contemporary population. Contrary to what previously reported by Neri et al. [11] and Oda et al. [21], these data support the potential for these patients to return to a quite normal, functioning, and integrated life, as shown by Olsson and Thelin [22]. In view of the clinical profile of these elderly patients, post-operative rehabilitation management plays a crucial role for the achievement of this task.

4.1. Study limitation

This study has several limitations. It is a retrospective analysis of a single institution experience and focuses its attention on a surgically treated and thus selected cohort of patients, over a quite long period of time. Although all patients referred to us were operated on consecutively and without selection, we are unable to tell of any possible selection criteria adopted by the referring physicians elsewhere, and not shared with us. Finally, the size of the study group does not always allow to outline causes and/or events supported by strong statistical evidence.

Still this experience allows for several inferences on the potential mid-term efficacy of the surgical management of AAD in the elderly, which in our view justify intervention. The availability of greater samples of patients, from single- or multi-center studies, might help to stratify pre-operative risk in order to better predict in-hospital mortality and to compare treated population among centers.

In conclusion, surgical repair of AAD should not be denied on the sole consideration of advance age. In our experience, overall results justify intervention, particularly in uncomplicated cases. Expeditious referral and intervention by lowering pre-operative dissection-related complications and comorbidities might help to further improve results. In view of the expertise and resources required to manage this cohort of patients, admission in high-volume cardiac surgical units linked to expert rehabilitation programs is recommended.

References


