Surgery for acute type A aortic dissection in octogenarians is justified

Gilbert H. L. Tang, MD, MSc, Ramin Malekan, MD, Cindy J. Yu, NP, Masashi Kai, MD, Steven L. Lansman, MD, PhD, and David Spielvogel, MD

Objective: Surgery in octogenarians with acute type A aortic dissection is commonly avoided or denied because of the high surgical morbidity and mortality reported in elderly patients. We sought to compare clinical and quality of life outcomes between octogenarians and those aged less than 80 years who underwent surgical repair at New York Medical College.

Methods: A total of 101 cases of acute type A aortic dissection repair between July 2005 and December 2011 were retrospectively analyzed, comparing 21 octogenarians with 80 concurrent patients aged less than 80 years. All patients underwent corrective surgery (ascending/hemiarch replacement in 71; Bentall in 22; David procedure in 2; Wheat procedure in 4; total arch replacement in 2) using deep hypothermic circulatory arrest. During follow-up, the RAND 36-Item Short Form Health Survey Questionnaire was used to assess quality of life.

Results: Octogenarians (average, 85 years; range, 80-91 years) were compared with the younger group (average, 60 years; range, 30-79 years). The 2 groups had similar preoperative characteristics, but the younger group experienced more malperfusion (40% vs 9%, $P = .002$), were more likely to have undergone a Bentall procedure (26% vs 5%, $P = .04$), and had longer circulatory arrest times (20 ± 7 minutes vs 16 ± 9 minutes, $P = .03$). The overall hospital mortality was 9% (9/101). Among octogenarians, there were no hospital deaths, no late deaths during follow-up (mean, 17 months; range, 1-59 months), and emotional health scores were better than those of the younger patients ($P = .04$).

Conclusions: Surgery for acute type A aortic dissection should be offered to octogenarians because excellent surgical and quality of life outcomes can be achieved even in this elderly population. (*J Thorac Cardiovasc Surg* 2013;145:S186-90)

Urgent surgery for type A aortic dissection is commonly avoided or withheld in elderly patients on the basis of poor outcomes in some series.¹ Among retrospective series of type A dissection repair, in-hospital mortality ranged from 18% to 43%²⁻⁶ for patients aged more than 70 years and 13% to 83% among octogenarians.^{1,7-9} Apart from age, specific predictors of operative mortality for acute type A dissection in the elderly population have not been identified, and poor outcomes have generally been attributed to dissection-related complications.^{5,10} Consequently, many cardiothoracic surgeons believe that the surgical mortality and morbidity for type A dissection in the elderly are prohibitive. More encouraging survival data have been reported,⁷ but postoperative quality of life, perhaps as important to octogenarians, has rarely been evaluated.¹⁰

The aging population, coupled with advancing life expectancy, will increasingly present surgeons with the question of whether to intervene in type A aortic dissections in the elderly. Therefore, the current study was undertaken to compare the clinical and quality of life outcomes between a contemporary series of patients aged 80 years or more versus less than 80 years who underwent urgent surgery for acute type A aortic dissection.

MATERIALS AND METHODS

Patients

We retrospectively evaluated 101 consecutive patients, including 21 patients aged 80 years or more, who underwent surgery for acute type A aortic dissection between July 2005 and December 2011. The New York Medical College is a regional tertiary referral center, with a C helicopter Stat Flight program covering a 100-mile radius. The study was approved by the New York Medical College Research Ethics Board.

Operative Technique

Possible acute type A aortic dissections are transported directly to the operating room, bypassing the emergency department or intensive care unit.¹¹ During preparation for anesthesia, the imaging studies are reviewed, and if the diagnosis remains in doubt, transesophageal echocardiography is performed under general anesthesia. On rare occasions, if suspicion persists but the imaging studies remain inconclusive, direct pericardioscopy is undertaken to establish the diagnosis.

All patients underwent corrective surgery (ascending/hemiarch replacement in 71, Bentall procedure in 22, David procedure in 2, Wheat procedure in 4, total arch replacement in 2) under hypothermic circulatory arrest. Our preferred access for cardiopulmonary bypass was direct axillary

From the Department of Surgery, Section of Cardiothoracic Surgery, New York Medical College, Westchester Medical Center, Valhalla, NY.

Disclosures: Drs Tang, Malekan, Yu, Kai, Lansman, Spielvogel have nothing to disclose with regard to commercial support.

Read at The American Association for Thoracic Surgery Aortic Symposium, New York, New York, April 26-27, 2012.

Received for publication April 23, 2012; revisions received Aug 6, 2012; accepted for publication Nov 28, 2012; available ahead of print Dec 26, 2012.

Address for reprints: David Spielvogel, MD, Cardiothoracic Surgery, Westchester Medical Center, 100 Woods Rd, Macy 114W, Valhalla, NY 10595 (E-mail: SpielvogelD@wmc.com).

0022-5223/\$36.00

Copyright © 2013 by The American Association for Thoracic Surgery

<http://dx.doi.org/10.1016/j.jtcvs.2012.11.060>

Abbreviations and Acronyms

IRAD = International Registry of Acute Aortic Dissection
SF-36 = 36-item Short Form

artery cannulation¹² (78%), but when that artery was dissected, we used femoral cannulation (14%) or ultrasound-guided direct cannulation of the true lumen of the distal ascending aorta (8%) using the Seldinger technique. Cold blood cardioplegia was administered antegrade via the coronary ostia or retrograde via the coronary sinus. The proximal repair was performed during core cooling and may have included resuspension of the aortic valve with a sinotubular repair, a reimplantation procedure, or Bentall procedure. All distal repairs were performed during a single period of deep hypothermic circulatory arrest (tympanic temperature <20°C, bladder temperature <22°C), and all aortic anastomoses used the “sandwich technique,” using a strip of Teflon felt outside the aorta and careful placement of the Dacron graft within the aortic lumen.¹³ Cardiopulmonary bypass was discontinued at a tympanic temperature of 34°C to 35°C and a bladder temperature of 32°C to 33.5°C.

Data Source and Definition

Prospectively collected data were retrospectively reviewed. Operative mortality was defined as death occurring during hospital admission or within 30 days of surgery. Follow-up information was obtained using the Social Security Index and through telephone interviews with surviving patients. Late death was defined as death more than 30 days after surgery or after discharge. In addition to inquiries regarding present functional status and hospital readmissions, follow-up evaluations included the RAND 36-item Short Form (SF-36) Health Survey Questionnaire, a validated, widely used, comprehensive quality of life questionnaire.¹⁴ It examines 8 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. It also includes an indication of perceived change in health.

Statistical Analysis

Statistical analysis was performed with GraphPad Prism version 5.00 (GraphPad Software Inc, La Jolla, Calif) for Mac OS X (Apple Inc, Cupertino, Calif). Categorical patient variables were compared using the Fisher exact test. Continuous variables were expressed as means $\pm$ standard deviations, and median and range, and were compared using Student *t* tests. Midterm survival and freedom from morbid events were compared using the Kaplan–Meier method.

RESULTS

Clinical and Operative Data

Clinical data are presented in Table 1. The mean age of the elderly group was 85 years (range, 80–91 years). The mean age of the younger group was 60 years (range, 30–79 years) ($P < .0001$). The proportion of female patients was significantly higher in the octogenarian group (81% vs 37%, $P < .0001$). There was no difference in comorbidities between the 2 groups, except that 40% (32/80) of younger patients had malperfusion compared with 9% (1/21) of octogenarians ($P = .002$). The only differences noted in the types of surgical procedures between groups

were that younger patients were more likely to have undergone a Bentall procedure (26% vs 5%, $P = .04$; Table 2) and that the duration of circulatory arrest was significantly longer in the younger group (20 ± 7 minutes vs 16 ± 9 minutes, $P = .03$; Table 2).

Mortality and Morbidity

No hospital deaths occurred in the elderly cohort (Table 3). The overall hospital mortality was 9% (9/101), but by excluding patients who were brought to the operating room in shock and subsequently died, hospital mortality was 4.0% (4/101). Causes of deaths were ruptured descending aortic aneurysm (1 patient), cardiogenic shock secondary to left main coronary artery occlusion (1 patient), shock with cardiac arrest (1 patient), multiple organ malperfusion (1 patient), visceral malperfusion (1 patient), multiorgan failure (1 patient), anoxic encephalopathy (1 patient), and cerebral malperfusion and stroke (2 patients). There was no significant difference in the in-hospital mortality between the 2 age groups ($P = .2$).

Mean follow-up was 17 ± 16 months (median, 14 months; range, 1–59 months; 96% [19/21] complete) among octogenarians and 20 ± 18 months (median, 14 months; range, 1–76 months; 86% [61/71] complete) among younger patients. Two octogenarians were lost to follow-up. Query of the Social Security Index indicates continued survival in 100% of the octogenarians (Figure 1). There were 3 late deaths (4.2%) among the 71 survivors aged less than 80 years. For the younger patients, the causes of death were heart failure (1 patient), myocardial infarction (1 patient), and respiratory decompensation after withdrawal of care (1 patient). There was no significant difference in late mortality between the 2 groups. In follow-up, there was no difference in major complications, such as myocardial infarction, stroke, renal failure, or organ malperfusion.

Quality of Life

The RAND SF-36 Health Survey Questionnaire was completed in 57 of 68 survivors aged less than 80 years and in 18 of 21 survivors aged 80 years or more. Physical functioning was significantly better in the younger group ($P = .006$), whereas role limitations due to emotional health were less frequent in the older group ($P = .04$). Other parameters representing quality of life measures of the surviving patients were similar between groups (Table 4).

DISCUSSION

This study, a contemporary series (2005–2011), is the first report of type A dissection repair in octogenarians from North America. Previous studies originated from Europe, Japan, and the International Registry of Acute Aortic Dissection (IRAD) registry. The salient findings are that excellent surgical outcome was obtained; in addition, quality of life did not differ from a compared group of younger

TABLE 1. Summary of patient characteristics and clinical presentation among the 101 patients with acute type A aortic dissection who underwent surgery at New York Medical College

Patient characteristics	Age $\geq$ 80 y (N = 21)	Age <80 y (N = 80)	P value
Mean age $\pm$ SD (range)	85 $\pm$ 3 (80-91)	60 $\pm$ 12 (30-79)	<.0001
Female	17 (81%)	21 (37%)	<.0001
Hypertension	19 (90%)	60 (75%)	.2
Diabetes mellitus	2 (10%)	10 (13%)	1.0
Smoking	2 (10%)	17 (21%)	.3
Coronary artery disease	6 (29%)	13 (16%)	.2
Peripheral vascular disease	10 (48%)	41 (51%)	.8
TIA	2 (10%)	3 (4%)	.3
CVA	3 (14%)	2 (3%)	.06
Chronic heart failure	0 (0%)	12 (15%)	.07
LVEF <40%	1 (5%)	5 (6%)	1.0
COPD	2 (10%)	4 (5%)	.6
Renal failure	1 (5%)	0 (0%)	.2
Marfan syndrome	0 (0%)	1 (1%)	1.0
Clinical presentation			
Tamponade	6 (29%)	15 (19%)	.4
Free rupture	1 (9%)	1 (1%)	.4
Contained rupture	9 (43%)	21 (26%)	.2
Shock	2 (10%)	7 (9%)	1.0
Malperfusion	1 (9%)	32 (40%)	.002
Coronary	0	7 (9%)	.3
Cerebral	1 (9%)	8 (10%)	.7
Mesenteric	0	6 (8%)	.3
Renal	0	2 (3%)	1.0
Iliofemoral	0	9 (11%)	.2

SD, Standard deviation; TIA, transient ischemic attack; CVA, cerebrovascular accident; LVEF, left ventricular ejection fraction; COPD, chronic obstructive pulmonary disease.

patients. Furthermore, the intermediate-term survival among octogenarians was similar to an age- and sex-matched population (Figure 1). Accordingly, we suggest that surgery for type A aortic dissection should not be denied in the elderly population.

A report of extremely poor outcomes for repair of acute type A aortic dissection in octogenarians by Neri and co-workers,¹ with 83% overall hospital mortality,¹ spurred a number of centers to review their outcomes with this

elderly, frail population. Piccardo and colleagues⁹ reported 45.6% hospital mortality in 57 octogenarians undergoing acute type A repair between 2000 and 2006, with a 5-year survival of 44%, recommending a judicious and less aggressive approach to these patients.⁹ However, some centers had more favorable results. Shiono and colleagues⁷ reported a 13% hospital mortality and late mortality of 38% among 24 octogenarians who underwent type A dissection repair between 1995 and 2005, and Hata and coworkers⁸ reported a 13.3% mortality among 30 octogenarians with a 5-year survival of 48.5%. Although these results were more encouraging, the authors cautioned that perioperative morbidity may leave these elderly patients with a poor quality of life.

The impact of age alone on emergency surgery for type A aortic dissection is not entirely understood. A recent IRAD report demonstrated that surgical mortality increased significantly with increasing age, but nonetheless was better than nonoperative therapy.¹⁵ A recent meta-analysis of 10 publications from 2001 to 2011 showed an overall mortality of 36.7% (111/308) for octogenarians, a 2.6-fold higher mortality risk than in younger patients.¹⁶ The authors concluded that immediate postoperative mortality was satisfactory and suggested that more data regarding intermediate survival and quality of life were needed.

The octogenarians in this study were not preselected and represent a consecutive series; approximately one third presented with cardiac tamponade, 9% had shock, and more than 40% had contained rupture of the dissection, making our octogenarian patients a highly acute surgical cohort, not unlike other series. There was no in-hospital mortality within this high-risk group, and all octogenarians remained alive during the postdischarge follow-up period. In comparison, only 50% of octogenarians and 20% of nonoctogenarians underwent surgery in IRAD, with an in-hospital mortality of more than 35% and 100%, respectively.¹⁵

We believe that our standard approach may favorably affect survival and outcome. Patients referred for acute type A dissection are transported directly to the operating room, bypassing the emergency department and intensive care unit,¹¹ where the final diagnosis is made. Avoiding delays

TABLE 2. Breakdown of the types of procedures performed in the treatment of acute type A dissection between octogenarians and younger patients and the respective intraoperative data

Procedure and intraoperative data	Age $\geq$ 80 y (N = 21)	Age <80 y (N = 80)	P value
Ascending aorta/hemiarch replacement	18 (85%)	53 (66%)	.1
Bentall procedure	1 (5%)	21 (25%)	.04
David procedure	0 (0%)	2 (3%)	1.0
Aortic valve and ascending aorta replacement (Wheat procedure)	2 (10%)	2 (3%)	.2
Total arch replacement	0 (0%)	2 (3%)	1.0
Concomitant CABG	4 (19%)	11 (14%)	.5
Cardiopulmonary bypass time (min)	177 $\pm$ 51 (118-345)	186 $\pm$ 48 (80-292)	.5
Myocardial ischemic time (min)	94 $\pm$ 42 (45-232)	103 $\pm$ 49 (39-210)	.4
Circulatory arrest time (min)	16 $\pm$ 9 (10-33)	20 $\pm$ 7 (9-40)	.03

Data are presented as mean $\pm$ standard deviation (range). CABG, Coronary artery bypass grafting.

FIGURE 1. Kaplan–Meier curve illustrating the 5-year survival of octogenarians who underwent type A dissection repair compared with the age- and sex-matched US population. The asterisk represents the age- and sex-matched controls whose expected survivals were based on US Social Security mortality rates from 2007.

in transfer, transport, and confirming the diagnosis at this stage allows precarious patients to be supported on cardiopulmonary bypass expeditiously. The series of operations were performed by 3 experienced aortic surgeons, using a consistent technique. All patients underwent deep hypothermic circulatory arrest, and in the octogenarian group there were no deaths and 1 stroke (5%), which compared favorably with the pooled mortality rate of 36.7% and stroke rate of 11.9% reported in the meta-analysis by Biancari and colleagues.¹⁶ Some considered the use of hypothermic circulatory arrest in octogenarians a cause of unfavorable neurologic results, contributing to loss of quality of life after aortic surgery. However, a recent study suggests that advanced age is not associated with increased risk for mortality and neurologic injury in patients undergoing surgical repair for aortic pathology with hypothermic circulatory arrest.¹⁷

TABLE 3. Postoperative outcomes of the 101 patients who underwent surgical treatment for acute type A aortic dissection

Outcomes	Age ≥80 (N = 21)	Age <80 (N = 80)	P value
Hospital death	0 (0%)	9 (11%)	.2
Late death (>30 d after surgery)	0 (0%)	3 (4%)	1.0
Stroke within 24 h	1 (5%)	4 (5%)	1.0
Stroke >24 h	0 (0%)	2 (3%)	1.0
Myocardial infarction	0 (0%)	0 (0%)	1.0
Renal failure	0 (0%)	6 (8%)	1.0
Sepsis	1 (5%)	3 (4%)	1.0
Sternal wound infection	0 (0%)	0 (0%)	1.0
Bleeding requiring reoperation	2 (10%)	7 (9%)	1.0
Respiratory failure	7 (33%)	22 (28%)	.6
Tracheotomy	3 (14%)	9 (11%)	.7
Gastrointestinal bleeding	0 (0%)	3 (4%)	1.0

TABLE 4. Quality of life scores among survivors of acute type A dissection repair who completed the RAND 36-Item Short Form Health Survey Questionnaire

Quality of life score components	Age ≥80 y (N = 18)	Age <80 y (N = 57)	P value
Physical functioning	43 ± 24	62 ± 25	.006
Role limitations because of physical health	39 ± 36	42 ± 41	.8
Role limitations because of emotional health	87 ± 26	66 ± 40	.04
Energy/fatigue	51 ± 15	51 ± 20	1.0
Emotional well-being	79 ± 14	75 ± 16	.3
Social functioning	68 ± 23	72 ± 27	.6
Pain score	81 ± 27	71 ± 24	.1
General health	69 ± 14	67 ± 17	.7

Data are presented as mean ± standard deviation. Among the patients aged 80 years or more, 2 did not complete the survey because of loss of follow-up. Among the patients aged less than 80 years, 57 surveys were completed, 12 died, and 11 were lost to follow-up.

We perform computed tomography angiography or magnetic resonance imaging postoperatively before discharge and obtain repeat studies at 6 months and yearly thereafter. In the entire group, there was no proximal re-dissection or aortic pseudoaneurysm formation during follow-up. We believe the “sandwich” anastomotic technique helps avoid these late-term complications.¹³

The other salient finding of this study is that RAND SF-36 quality of life surveys revealed that octogenarians who survived surgery did well in terms of emotional and social well-being, although, as might be expected, physical functioning scores were lower than those of their younger counterparts. Santini and colleagues¹⁰ found that quality of life scores among 19 long-term survivors aged more than 75 years after type A dissection repair were similar to those of the general, age-matched population in Italy. These results suggest a much better outlook for this elderly population than the report by Neri and coworkers,¹ wherein no survivor was independently functional 6 months after surgery.

Study Limitations

The findings of the present study should be viewed in the light of its limitations. This was a retrospective analysis of clinical experience in a single institution, with a small sample size of octogenarians. There were a disproportionate number of female patients in the octogenarian group, probably reflecting the age-matched sex proportions in the general population. Better candidates were probably referred from smaller community hospitals, producing bias, although we maintain an aggressive surgical policy once the patient has been referred. Because we did not decline surgery for any of the patients during this study period, we had no comparison between the surgical group and a medically managed group.

CONCLUSIONS

Acute aortic dissection repair in octogenarians compares favorably with a younger patient cohort, with a low hospital mortality. Octogenarians who survive surgery recover a good quality of life once discharged from the hospital. We suggest that surgical repair for acute type A aortic dissection be considered in octogenarians and think that a biologically based, rather than an age-based, treatment approach is warranted if the underlying aortic pathology is the only limiting disease.

References

1. Neri E, Toscano T, Massetti M, Capannini G, Carone E, Tucci E, et al. Operation for acute type A aortic dissection in octogenarians: is it justified? *J Thorac Cardiovasc Surg.* 2001;121:259-67.
2. Chiappini B, Tan ME, Morshuis W, Kelder H, Dossche K, Schepens M. Surgery for acute type A aortic dissection: is advanced age a contraindication? *Ann Thorac Surg.* 2004;78:585-90.
3. Stamou SC, Hagberg RC, Khabbaz KR, Stiegel MR, Reames MK, Skipper E, et al. Is advanced age a contraindication for emergent repair of acute type A aortic dissection? *Interact Cardiovasc Thorac Surg.* 2010;10:539-44.
4. Shrestha M, Khaladj N, Haverich A, Hagl C. Is treatment of acute type A aortic dissection in septuagenarians justifiable? *Asian Cardiovasc Thorac Ann.* 2008;16:33-6.
5. Caus T, Frapier JM, Giorgi R, Aymard T, Riberi A, Albat B, et al. Clinical outcome after repair of acute type A dissection in patients over 70 years-old. *Eur J Cardiothorac Surg.* 2002;22:211-7.
6. Mehta RH, O'Gara PT, Bossone E, Nienaber CA, Myrmel T, Cooper JV, et al. International Registry of Acute Aortic Dissection (IRAD) Investigators. Acute type A aortic dissection in the elderly: clinical characteristics, management, and outcomes in the current era. *J Am Coll Cardiol.* 2002;40:685-92.
7. Shiono M, Hata M, Sezai A, Iida M, Yagi S, Negishi N. Emergency surgery for acute type A aortic dissection in octogenarians. *Ann Thorac Surg.* 2006;82:554-9.
8. Hata M, Sezai A, Niino T, Yoda M, Unosawa S, Furukawa N, et al. Should emergency surgical intervention be performed for an octogenarian with type A acute aortic dissection? *J Thorac Cardiovasc Surg.* 2008;135:1042-6.
9. Piccardo A, Regesta T, Zannis K, Gariboldi V, Pansini S, Tapia M, et al. Outcomes after surgical treatment for type A acute aortic dissection in octogenarians: a multicenter study. *Ann Thorac Surg.* 2009;88:491-7.
10. Santini F, Montalbano G, Messina A, D'Onofrio A, Casali G, Viscardi F, et al. Survival and quality of life after repair of acute type A aortic dissection in patients aged 75 years and older justify intervention. *Eur J Cardiothorac Surg.* 2006;29:386-91.
11. Bavaria JE, Pochettino A, Brinster DR, Gorman RC, McGarvey ML, Gorman JH, et al. New paradigms and improved results for the surgical treatment of acute type A dissection. *Ann Surg.* 2001;234:334-42.
12. Strauch JT, Spielvogel D, Lauten A, Lansman SL, McMurtry K, Bodian CA, et al. Axillary artery cannulation: routine use in ascending aorta and aortic arch replacement. *Ann Thorac Surg.* 2004;78:103-8.
13. Strauch JT, Spielvogel D, Lansman SL, Lauten AL, Bodian C, Griep RB. Long-term integrity of Teflon felt-supported suture lines in aortic surgery. *Ann Thorac Surg.* 2005;79:796-800.
14. Fruitman DS, MacDougall CE, Ross DB. Cardiac surgery in octogenarians: can elderly patients benefit? Quality of life after cardiac surgery. *Ann Thorac Surg.* 1999;68:2129-35.
15. Trimarchi S, Eagle KA, Nienaber CA, Rampoldi V, Jonker FH, De Vincentiis C, et al. International Registry of Acute Aortic Dissection Investigators. Role of age in acute type A aortic dissection outcome: report from the International Registry of Acute Aortic Dissection (IRAD). *J Thorac Cardiovasc Surg.* 2010;140:784-9.
16. Biancari F, Vasques F, Benenati V, Juvonen T. Contemporary results after surgical repair of type A aortic dissection in patients aged 80 years and older: a systematic review and meta-analysis. *Eur J Cardiothorac Surg.* 2011;40:1058-63.
17. Shah PJ, Estrera AL, Miller CC 3rd, Lee TY, Irani AD, Meada R, et al. Analysis of ascending and transverse aortic arch repair in octogenarians. *Ann Thorac Surg.* 2008;86:774-9.