Is Conventional Open Repair Still a Good Option for Aortic Arch Aneurysm in Patients of Advanced Age?

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Background. **Although thoracic endovascular aortic repair has advantages in elderly patients, it is not always applicable, and some elderly patients require open surgical repair.**

Methods. **Between 2008 and 2014, 157 patients (11 men) older then 75 years (mean age, 79.3 ± 3.3 years) underwent conventional total arch replacement, of which 39 were emergency operations. Coexisting diseases included remote stroke in 54 patients, coronary artery disease in 64, chronic obstructive pulmonary disease in 25, and chronic kidney disease in 112. Concomitant procedures were performed in 46 patients.**

Results. **Mean follow-up time was 2.9 ± 1.8 years. Mean cardiopulmonary bypass time was 251.1 ± 68.4 minutes. Mean lowest nasopharyngeal temperature was 23.2° ± 3.4°C. The hospital mortality rate was 7.6% (12 of 157) overall, 5.1% in elective cases, and 15.4% in emergency cases. Postoperative complications included permanent neurologic dysfunction in 5.7% of patients and prolonged ventilation time exceeding 72 hours in 13.4%. No spinal cord complications occurred. The 1-year and 5-year survival rates were 88.2% and 69.2% in all cases and 91.3% and 77.0% in elective cases, respectively. Univariate analysis demonstrated that risk factors for hospital death in elective cases were chronic kidney disease (odds ratio, 4.00; $p = 0.028$) and ventilation time exceeding 72 hours (odds ratio, 13.3; $p = 0.001$).**

Conclusions. **Even in patients older than 75 years, recent surgical results of conventional open arch repair were acceptable, especially in elective cases. Thus, conventional open surgical aortic arch replacement remains a good option, especially in patients with preserved renal function.**

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Advances in surgical techniques and perioperative care in cardiovascular surgery have drastically reduced the mortality and morbidity associated with aortic arch operations in recent years [1–9]. The outcomes of aortic operations in elderly patients are usually assumed to be poorer than those in a younger population. The number of septuagenarians and octogenarians is steadily increasing in developed countries.

Thoracic endovascular aortic repair (TEVAR) has been recognized as an alternative therapeutic option for arch aneurysms. Since 2008 we began to apply hybrid TEVAR for arch aneurysms, mainly in select elderly patients. We continue to perform conventional total arch replacement (TAR) in patients who are not good candidates for hybrid TEVAR. We believe patients undergoing TAR tend to have more risks than before. This study reviewed and analyzed outcomes of conventional TAR in patients aged older than 75 years.

Patients and Methods

Patients

From January 2008 to April 2014, 157 patients (111 men) older than 75 years underwent conventional TAR (mean age, 79.3 ± 3.3 years; range, 75 to 92 years). Figure 1 shows patient distribution by age. There were 39 emergency operations for acute aortic dissection type A in 24 patients, acute aortic dissection type B in 2, and rupture of arch aneurysm in 13. Perioperative comorbidities included remote stroke in 53 patients, coronary artery disease in 64, chronic obstructive pulmonary disease in 25, and prior sternotomy in 14 (Table 1). In 26 patients with acute aortic dissection, 1 had brain malperfusion and 1 had right coronary artery malperfusion.

Surgical Strategy for Aortic Arch Aneurysm

Since 2008, we have chosen hybrid TEVAR to treat aortic arch aneurysms in high-risk patients. We defined the high-risk group as those older than 75 years with severe

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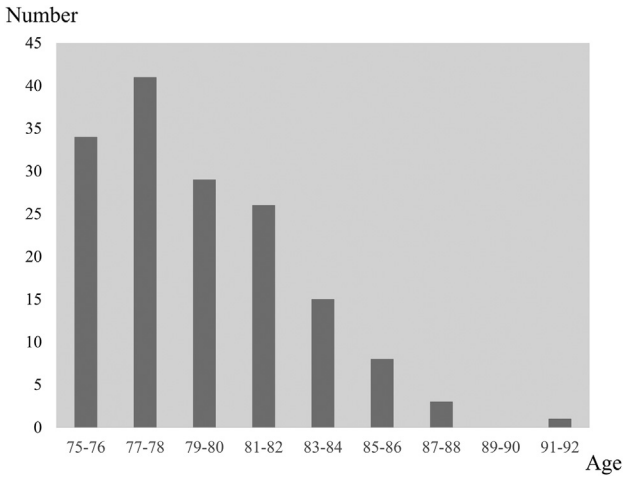

Fig 1. The age distribution is shown of the patients included in the study.

comorbidities such as chronic obstructive pulmonary disease and cardiac dysfunction. Conventional TAR was performed in patients at low risk for an open operation or who needed concomitant cardiac procedures such as aortic valve replacement or coronary artery bypass grafting. Patients with severe shaggy aorta or an ascending aorta dilated more than 40 mm on a preoperative enhanced computed tomography scan also underwent conventional TAR.

Operative Technique

All operative maneuvers were performed through a median sternotomy. The femoral artery or ascending aorta was used as a cannulation site for arterial return. Ascending aortic cannulation was preferred when epiaortic echography detected a minimal atherosclerotic change in the ascending aorta. However, femoral arterial cannulation was selected when the ascending aorta had severe atherosclerotic changes or in the presence of acute aortic dissection. The right axillary artery was additionally cannulated when the femoral artery was cannulated or the brachiocephalic artery had severe atherosclerotic changes.

Patients were cooled using the alpha-stat method of pH control until the nasopharyngeal temperature reached 20°C to 28°C [10]. Reperfusion and rewarming were always performed in an antegrade manner through the side branch of the graft. Collagen-woven Dacron grafts (DuPont, Wilmington, DE) were used for graft replacement. Arch vessels were independently reconstructed with quadrifurcated grafts in all patients.

Open distal anastomosis was performed in all cases and was always performed with complete transection of the descending aorta distal to the left subclavian artery for TAR. The short graft interposition technique was used for distal anastomosis in all patients. A short graft was introduced into the lumen of the descending aorta from the stump and then sewn to the aortic wall with a 4-0 polypropylene running suture. The short graft was then pulled out of the descending aorta. At the suture line, the graft was inverted circumferentially and fixed to the aortic wall in an appropriate manner. Finally, the quadrifurcated graft was anastomosed to the short graft with a 3-0 polypropylene running suture (Fig 2) [11]. This was followed by anastomosis of the left subclavian artery, proximal anastomosis to the ascending aorta, reconstruction of the left internal carotid artery, and anastomosis of the brachiocephalic artery.

Table 1. Characteristics of Patients Undergoing Aortic Arch Aneurysm Repair (January 2008 to April 2014)

Characteristics	% (No.) or Mean ± SD (range) (N = 157)
Male	70.7 (111)
Age, y	79.3 ± 3.3 (75–92)
Age >80 years	40.8 (64)
Aortic pathology	
Aortic dissection	21.7 (34)
Acute type A	16.6 (24)
Acute type B	1.3 (2)
Nondissection	78.3 (123)
Shaggy aorta	3.2 (5)
Emergency operation	24.8 (39)
Rupture	8.3 (13)
Shock status	6.4 (10)
Coexisting diseases	
Hypertension	87.9 (138)
Diabetes	18.5 (29)
Hyperlipidemia	44.6 (70)
Remote stroke	33.8 (53)
Coronary artery disease	40.8 (64)
COPD	15.9 (25)
Chronic kidney disease	
eGFR <60 mL/min/1.73 m^2	71.3 (112)
eGFR <30 mL/min/1.73 m^2	17.2 (27)
Hemodialysis	1.3 (2)
Prior sternotomy	8.9 (14)
Organ malperfusion (acute aortic dissection)	
Brain	0.6 (1)
Coronary	0.6 (1)
STS Risk Score	
Hospital mortality, %	4.2 ± 6.6
Permanent neurologic dysfunction, %	1.6 ± 0.9
Prolonged ventilation (>24 h), %	14.5 ± 13.4
Concomitant procedures	29.3 (46)
Cannulation sites	
Ascending aorta	39.5 (62)
Femoral artery	1.9 (3)
Femoral artery + right axillary artery	58.6 (92)

COPD = chronic obstructive pulmonary disease; eGFR = estimated glomerular filtration rate; SD = standard deviation; STS = The Society of Thoracic Surgeons.