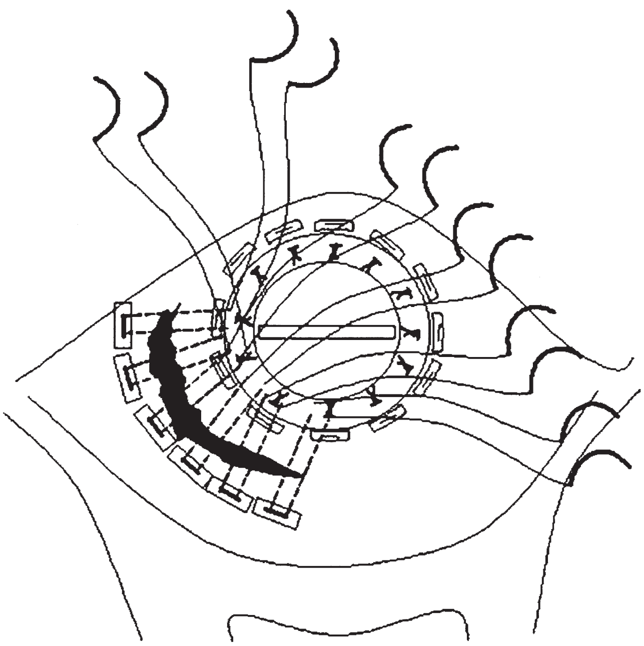

Figure 2. Reparative technique.

normal-sized prosthesis has been used. An overzealous thrombi removal has been implicated, but LAD has also been described when there were no thrombi in the left atrium. LAD can be the consequence of extreme tissue fragility in the case of multiple sclerosis or floppy mitral valve, but it has been found in patients with normal-appearing tissues. Endocarditis can be responsible, but LAD has been described in the absence of endocarditis. At the echocardiogram LAD can mimic a mitral insufficiency and an abnormal cavity protruding and compressing into the left atrium. Immediate surgical treatment may be undertaken, but it may also be left alone and periodically controlled. Surgical treatment requires closure of the dissection, but an internal drainage has been described.

From this confusing clinical picture we conclude that LAD must be suspected in every patient who does not improve after valve surgery or presents with clinical deterioration after an initial improvement. In these patients, TEE is always mandatory.

References

1. Martinez-Sellés M, Garcia-Fernandez MA, Moreno M, Bermejo J, Delcán JL. Echocardiographic features of left atrial dissection. *Eur J Echocardiography.* 2000;1:147-50.
2. Sekino Y, Sadahiro M, Tabayashi K. Successful surgical repair of left atrial dissection after mitral valve replacement. *Ann Thorac Surg.* 1996; 61:1528-30.
3. Ninomiya M, Taketani T, Ohtsuka T, Motomura N, Takamoto S. A rare type of left atrial dissection. *J Thorac Cardiovasc Surg.* 2002;124:618-20.
4. Osawa H, Yoshii S, Hosaka S, Suzuki S, Abraham SJK, Tada Y. Left atrial dissection after aortic valve replacement. *J Thorac Cardiovasc Surg.* 2003;126:604-5.
5. Karlson KJ, Ashraf MM, Berger RL. Rupture of the left ventricle following mitral valve replacement. *Ann Thorac Surg.* 1988;46:590-97.

Mild hypothermia (32°C) and antegrade cerebral perfusion in aortic arch operations

Farhad Bakhtiary, MD, Selami Dogan, MD, Omer Dzemali, MD, Peter Kleine, MD, PhD, Anton Moritz, MD, PhD, and Tayfun Aybek, MD, PhD, Frankfurt/Main, Germany

Antegrade cerebral perfusion (ACP) has been popularized, offering a more physiologic method of perfusion and extending the safe limits for arch repair.[1] Deep hypothermia has been used as an adjunct to ACP almost universally. The absolute necessity for deep hypothermia once ACP with flow rates and pressures within the physiologic range is provided has been questioned recently. Ehrlich and colleagues[2] showed that brain oxygen consumption is reduced by 50% of baseline values if the patient is cooled systemically to 28°C core temperature. Yet the regional cerebral blood flow with antegrade perfusion decreases more rapidly at less than 28°C than between 36°C and 30°C.[3] Thus a perfusate temperature of greater than 28°C should be optimal for ACP to meet the lowered metabolic demands of the brain. By using this modified temperature management, the drawbacks of long cooling and rewarming periods on cardiopulmonary bypass (CPB) could be avoided. This article describes the operative management with this concept.

From the Department of Thoracic and Cardiovascular Surgery, Johann Wolfgang Goethe University Hospital, Frankfurt/Main, Germany.

Address for reprints: Farhad Bakhtiary, MD, Department of Thoracic and Cardiovascular Surgery, Johann Wolfgang Goethe University, Theodor Stern Kai 7, 60590 Frankfurt/M, Germany (E-mail: farhad@bakhtiary.de).

J Thorac Cardiovasc Surg 2006;132:153-4

0022-5223/$32.00

doi:10.1016/j.jtcvs.2006.03.028

Technique

After systemic heparinization (300 IU/kg), the right subclavian artery is exposed through a 4-cm subclavian incision. Cannulation

Table 1. Patient demographics

	Type A dissection (n = 24)	Aneurysm (n = 22)
Age (mean ± SD)	58 ± 11	62 ± 12
Aortic regurgitation >1°	12 (50%)	6 (27%)
Pericardial effusion	14 (58%)	—
Porcelain aorta	—	6 (27%)
Cardiopulmonary bypass time (min)	112 ± 54	128 ± 44
Myocardial ischemic time (min)	74 ± 41	86 ± 29
Isolated cerebral perfusion time (min)	17 ± 2.6	12 ± 4.4
Core temperature (°C)	30.1 ± 0.7	30.8 ± 1.0
Tirone David procedure	3 (12%)	4 (18%)
Aortic valved conduit	2 (8%)	4 (18%)
Aortic valve replacement	—	6 (27%)
Coronary artery bypass grafting	2 (8%)	12 (54%)
Intensive care unit stay (h)	48 ± 34	36 ± 22
Ventilation time (h)	18 ± 16	14 ± 12
Chest tube drainage (mL/24 h)	672 ± 320	582 ± 292
Re-exploration for bleeding	3 (12%)	1 (4%)
Temporary neurologic dysfunction	2 (8%)	—
Permanent neurologic deficit	1 (4%)	—
Hospital stay (d)	7.2 ± 2.6	8.4 ± 3.6
Mortality (30 d)	1 (4%)	1 (4%)

SD, Standard deviation.

is performed with an 18F to 22F flexible standard arterial cannula in an occlusive technique.

After median sternotomy, the right atrium is cannulated with a standard double-stage venous cannula. CPB is started, and the heart is arrested with blood cardioplegia. Cooling is limited to a rectal temperature of 32°C. The innominate and left common carotid arteries, as well as the left subclavian artery, are exposed, snared with vessel loops, and occluded at the time of initiation of ACP.

ACP is conducted with a 30°C to 32°C arterial perfusate flow in a pressure-controlled manner. The upper permissible level was 75 mm Hg, and this allowed for a flow of 1340 ± 148 mL/min. With the cerebral vessels occluded, a bloodless operative field during arch repair is accomplished. At this point, the arch resection and repair is initiated. In dissections the inner and outer layers of the arch wall are dried carefully and glued with standard bicomponent glue. The distal anastomosis with a collagen-coated woven polyester graft is completed in a continuous fashion with polypropylene 4-0 sutures and, if necessary, reinforced with Teflon felt. Once distal repair is completed and hemostasis is secured, deairing is performed, and finally, the prosthetic graft is clamped just proximal to the innominate artery. At this point, the arterial flow on CPB is returned to full-body perfusion. All procedures were performed by a single surgeon.

Results

Between April 2001 and August 2004, 46 patients (27 male and 19 female patients) underwent operative treatment of diseased ascending aorta, transverse arch, or both caused by chronic aneurysmal involvement (n = 22, 48%) or acute dissection (n = 24, 52%) in mild hypothermic conditions (Table 1).

Table 2. Distribution of cause

	Dissection	Aneurysm
MFS	1 (4%)	—
Chronic dissection	1 (4%)	—
Hypertension	15 (62.5%)	11 (50%)
Atherosclerosis	7 (29.2%)	9 (41%)

MFS, Marfan syndrome.

The 30-day mortality in this series was 4.3%. One patient with dissection presented in cardiogenic shock with pericardial tamponade. Postoperatively, he presented a permanent neurologic deficit, which was the only such case in our series (2.1%). This patient was admitted to our unit with convulsion, as well as motoric aphasia before surgical intervention. Postoperatively, the computed tomographic scan of the brain showed ischemia of the left hemisphere. Two other patients had temporary neurologic deficits that were completely reversible at discharge. A second patient with aneurysm required aortic valve replacement and quadruple bypass. He experienced respiratory failure. Both patients died of multiorgan failure. There were signs of neither spinal cord–peripheral nerve injury nor acute organ malperfusion. Six (13%) patients had renal failure caused by preexisting impaired renal function. The other results are shown in Table 2.

Conclusion

Mild hypothermia decreases the brain oxygen demand by half.[2] If the brain temperature is kept in this range, the regional cerebral blood flow should not decrease.[3] Providing a blood flow in the physiologic range, the cerebral oxygen demands should be met, even in patients presenting with hemodynamic instability.

On the basis of these studies, we have started to use 32°C mild systemic hypothermia together with ACP for operations on the aortic arch. The aim of the use of mild hypothermia was to decrease CPB time and its negative side effects during cooling and rewarming while providing protection for the rest of the body. This article shows the safety and reproducibility of mild hypothermia in 46 patients with aortic arch aneurysms of different causes. Our mortality and new-stroke rates in this series are well comparable with those in previously published reports.[1,4]

In conclusion, selective ACP with mild systemic hypothermia appears to be a safe and sufficient concept for brain protection during arch repair. In avoiding deep hypothermia, this technique might help to reduce CPB time and deep hypothermia–related side effects.

References

1. Sabik JF, Lytle BW, McCarthy PM, Cosgrove DM. Axillary artery: an alternative site of arterial cannulation for patients with extensive aortic and peripheral vascular disease. *J Thorac Cardiovasc Surg.* 1995;109:885-91.
2. Ehrlich MP, McCullough JN, Zhang N, Weisz DJ, Juvonen T, Bodian CA, et al. Effect of hypothermia on cerebral blood flow and metabolism in the pig. *Ann Thorac Surg.* 2002;73:191-7.
3. Usui A, Oohara K, Murakami F, Ooshima H, Kawamura M, Murase M. Body temperature influences regional tissue blood flow during retrograde cerebral perfusion. *J Thorac Cardiovasc Surg.* 1997;114:440-7.
4. Di Eusanio M, Wesselink RM, Morshuis WJ, Dossche KM, Schepens MA. Deep hypothermic circulatory arrest and antegrade selective cerebral perfusion during ascending aorta-hemiarch replacement: a retrospective comparative study. *J Thorac Cardiovasc Surg.* 2003;125:849-54.