Late reoperations after repaired acute type A aortic dissection

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Objective: Late complications can develop in patients after surgery for aortic type A dissection, mandating redo surgery on the ascending aorta and arch.

Methods: From 2006 to 2010, 23 patients (aged 41–69 years) who had late complications related to previous aortic surgery for acute type A dissection underwent redo surgery. Initial surgery included ascending aorta replacement in all cases.

Results: The main indications for reoperation were progressive enlargement of the false lumen of the aortic arch or descending aorta and suture line dehiscence in 10 patients each. All patients with progressive aneurysm formation in nonresected aortic segments had persistent dissection within the aortic arch since initial surgery. Suture line dehiscence led to a localized hematoma in most cases. Three patients presented with graft infection and extensive perigraft hematoma. The average time interval from the initial repair to the redo procedure was 71 ± 56 months. Exchange of the formerly implanted Dacron graft in the ascending aorta was the most frequently used surgical procedure. Implantation of a valved conduit was deemed necessary in 4 cases, and isolated aortic valve replacement was necessary in 2 cases. A hybrid stent graft was used in 6 patients. All patients survived surgery, and 1 patient died of postoperative low output cardiac failure in hospital. Only 1 major stroke was noted.

Conclusions: Complex reoperations for repaired acute type A dissection can be performed safely. The concern for the reoperative risk should not dictate the operative strategy during the initial procedure in acute type A dissection. (*J Thorac Cardiovasc Surg* 2012;144:300-7)

The development of type A aortic dissection (ie, involving the ascending aorta or aortic arch) is a life-threatening disease with a high mortality rate if left untreated. A mortality of 1% per hour and an expected mortality of 70% to 90% during the first 3 months have been reported.¹ More recently, results have improved with advances in diagnosis, better surgical techniques, and modern intensive care unit care.² Therapy of choice usually consists of replacement of that part of the ascending aorta, which has a tear in the endothelial layer and involves the aortic arch in approximately half of the patients.³ The average 30-day mortality in Germany is reported to be 18.5%.³

Despite successful emergency surgery and uneventful recovery, many patients are far from being definitely cured. Regardless of the surgical techniques used, diseased aortic tissue is left in situ, which may become the source of late complications. The most susceptible region with regard to

postsurgical adverse sequelae is the aortic arch. Up to 43% of patients demonstrate persistent dissection in a previously not replaced aortic arch.⁴ As a consequence, 10% to 27% of patients experience a late increase of the false lumen, which may cause pain or rupture.⁵ Further problems include the formation of pseudoaneurysms at the suture lines and valvular incompetence of the aortic root.^{6,7}

We analyzed our patient cohort with residual or recurrent aortic disease of type A dissection mandating redo surgery on the ascending aorta and arch.

PATIENTS AND METHODS

Patient Data

From 1998 to October 2010, 228 patients underwent aortic surgery for acute type A dissection at the University Medical Center. Diagnosis was established on the basis of preoperative computed tomography (CT) or echocardiography. Because most of the patients live in a rural countryside and usually consult a physician rather late despite being burdened with numerous general risk factors, including obesity, hypertension, and diabetes, the primary surgical strategy was to achieve patient survival and not to perform aggressive aortic arch replacement. The aortic valve was preserved in 87% of cases (ie, whenever possible).

A survey of our aortic surgery database revealed 23 patients with late complications related to previous aortic surgery for acute aortic type A dissection during follow-up and mandating redo aortic surgery. There were 19 male and 4 female patients aged 41 to 69 years (mean, 56 ± 8 years). Some 74% of patients had a body mass index above normal levels (mean, 27 ± 3.2). The prevalence of cardiovascular risk factors was low except for arterial hypertension, which was also seen in 74% of patients (Table 1). The actual mean European System for Cardiac Operative Risk Evaluation was 13 ± 9 .

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Abbreviations and Acronyms

CT = computed tomography

GRFG = gelatin-resorcinol-formaldehyde-glutaraldehyde

Primary Surgical Procedures

After acute type A dissection, most patients underwent replacement of the ascending aorta with or without aortic valve resuspension or replacement, and an open distal anastomosis with or without hemiarch replacement during hypothermic circulatory arrest and antegrade cerebral perfusion. The false lumen of the aorta was mostly obliterated with gelatin-resorcinol-formaldehyde-glutaraldehyde (GRFG) biologic glue; far less often it was sutured with Teflon felt as abutment. The anastomoses between the Dacron prosthesis and the aortic wall were performed with monofilament running sutures. A mechanical valve conduit was used in 5 patients, and the Yacoub technique was used in 1 patient. A separate aortic valve replacement was performed in 1 patient. Aortic arch surgery was performed in 5 patients, 3 of whom had a hemiarch procedure. An elephant trunk was performed in 1 patient (Figure 1). Transesophageal echocardiography was routinely used to control for residual flow in the false lumen of the aortic arch and descending aorta. A significant flow was not seen in the false lumen, neither antegrade nor retrograde, in any patient. After recovery and discharge, all patients were scheduled for regular follow-up CT scans at the outpatient clinic of University Medical Center. After the initial procedure, 5 patients had undergone further procedures during consecutive hospital stays (Table 2).

Aortic Redo Procedures

Reoperation for development of progressive false aneurysm, enlargement of a persistently perfused false lumen, and graft infection followed the same surgical principles compared with the initial surgical procedure. The arterial access was at the surgeon's discretion, but prophylactic cannulation of the femoral artery was preferred in emergency cases with extensive subternal bleeding, that is, ruptured aneurysm or suture line failure (Table 2). The venous line was inserted into the right atrium except for (expected) uncontrollable bleeding after sternotomy. After the onset of extracorporeal circulation, deep hypothermia (20°C in tympanum and bladder) was initiated if aortic arch repair was intended. Near-infrared spectroscopy was used for cerebral monitoring. Otherwise, only mild to moderate hypothermia was induced (28°C–32°C).

The surgical techniques were adapted to the patient's aortic pathology, but the ascending aorta/aortic root was always operated first and the aortic arch was operated last. An aortic root replacement was performed using standard techniques. Mechanical valved conduits were obtained from Carbomedics (Sorin Inc, Austin, Tex). Biological valved conduits were custom-made by inserting a Perimount valve (Baxter Healthcare Corporation CardioVascular Group, Irvine, Calif) into an appropriately sized Dacron tubular graft. For arch repair or replacement, continuous cerebral perfusion was granted by maintaining a flow of 0.5 to 1.0 L/min via the arterial cannula in the right subclavian artery, simultaneously clamping the brachiocephalic trunk and the left carotid artery, or by inserting 2 inflatable balloon catheters into the orifices of the carotid vessels. The frozen elephant trunk technique included transecting the aorta distal to the offspring of the left subclavian artery, inserting the Evita open hybrid stent graft (Jotec GmbH, Hechingen, Germany) guided by a femorally advanced guide wire and transesophageal echocardiography into the true lumen, deploying the covered stent (14 cm in length), suturing the prosthesis to the wall of the proximal end of the descending aorta, and reinserting the head vessels into the Dacron graft.^{8,9} Because preoperative sizing for the stent graft prosthesis was difficult, especially in case of partial or

complete thrombotic obliteration of the false lumen, definitive sizing was accomplished during visual inspection of the true lumen of the descending aorta. For a conventional elephant trunk prosthesis, the tubular Dacron graft was fixed to allow 6 to 8 cm of the distal end floating in the descending aorta (Table 3).

Statistical Analysis

All patient data were prospectively collected in the institutional database during the regular follow-ups. Patient surveillance visits, including CT controls, were scheduled at 4, 10, 22, 34, 52, and 70 months, and then biannually. Follow-up was 100% complete. Statistical analysis was performed using the Statistical Package for the Social Sciences 16.0 software (SPSS, Chicago, Ill). Continuous data were calculated as a mean $\pm$ standard deviation; categorical variables were displayed as frequency distributions (n) and simple percentages (%).

RESULTS

Indications for Redo Surgery

The main indications for reoperation were progressive or symptomatic enlargement of the false lumen of the aortic arch or descending aorta and suture line dehiscence in 10 patients each (43%). A diameter exceeding 6 cm was considered an indication for surgery regardless of symptoms. Asymptomatic patients were scheduled for surgery if aortic enlargement was 1 cm or more per year.

All patients with progressive aneurysm formation in non-resected aortic segments had persistent dissection within the aortic arch since the initial surgery. The proximal descending aorta directly after the orifice of left subclavian artery was most often affected. Of note, there was no continuous increase in aortic diameter after primary surgery. Instead, aortic growth started only 1 to 3 years before redo surgery in most cases.

Suture line dehiscence developed at proximal or distal suture lines or coronary buttons and led to a localized hematoma (false aneurysm) contained by ubiquitous adhesions in most cases (70%). These patients remained hemodynamically stable and were able to undergo operation on an elective or urgent basis (78%). Five patients underwent emergency redo surgery (22%), 3 of whom presented with suture line dehiscence due to graft infection and extensive perigraft hematoma (30%) reaching the backside of the sternum (Figure 2). The other 2 patients had aortic arch rupture (distal suture line) with severe cardiovascular compromise.

An aneurysmal aortic root with valvular incompetence was noted in only 2 patients. Secondary tissue necrosis and redissection, which has been attributed to the use of GRFG glue, was not present.

The time interval from the initial repair after acute type A aortic dissection to the redo procedure varied from 3 to 214 months, with a mean of 71 ± 56 months (median, 75 months) (Table 1).

Surgical Procedures

Exchange or (partial) replacement of the formerly implanted Dacron graft in the ascending aorta was the most

TABLE 1. Patient characteristics

	No. of patients	%
Age	56 ± 8 y	
Sex	19 male, 4 female	
BMI	27 ± 3.2	
Hypertension	17	74
Coronary artery disease	3	13
Peripheral vascular disease	1	4
COPD	1	4
Diabetes	1	4
Prior cerebrovascular disease	3	13
Kidney dysfunction	3	13
Prior sternotomy	23	100

BMI, Body mass index; COPD, chronic obstructive pulmonary disease.

frequently used surgical procedure (n = 15, 65%). Implantation of a valved conduit was deemed necessary in 4 patients, and isolated aortic valve replacement was necessary in 2 patients. The need to extend the aortic procedure toward a hemiarch replacement was necessary in 5 patients, and a total arch replacement was indicated in 11 patients (48%). In 6 of the latter patients, the Evita open hybrid stent graft was used, that is, a covered stent was used in the descending aorta. Separate covered aortic stents were inserted in an antegrade fashion via a side-arm of the arch prosthesis during reperfusion in 2 cases. In the 3 patients with (suspected) graft infection, extensive mediastinal irrigation was performed, but no omental or muscle flap transfer.

Arterial cannulation was achieved via the femoral or subclavian artery in 8 patients each, and direct aortic cannulation was possible in 7 patients. Extracorporeal circulation time ranged from 61 to 385 minutes (198 ± 81 minutes), and crossclamp time ranged from 36 to 215 minutes (113 ± 53 minutes). Deep hypothermic circulatory arrest was necessary in 19 patients (83%), lasting 19 to 103 minutes (60 ± 25 minutes), and selective cerebral perfusion was carried out for 17 to 99 minutes (46 ± 25 minutes) (Table 2).

Survival and Complications

All patients survived surgery, and 1 patient died of postoperative low output cardiac failure in-hospital; thus, the success rate was 96%. Postoperative drainage losses ranged from 100 to 3900 mL (mean 1300 ± 1100 mL). Redo sternotomy for suspected or manifest bleeding was performed in 5 patients. Extubation was achieved after 4 to 1300 hours (median 36 hours). Two patients required tracheostomy for prolonged mechanical ventilation. Only 1 major stroke with incomplete resolution of symptoms was noted after surgery. Vocal chord palsy was observed in 6 patients. Acute kidney failure necessitating temporary hemodialysis developed in 3 patients.

Patients remained in the intensive care unit for 2 to 53 days (median, 8 days) and were discharged after 5 to 57 days (median, 15 days). All patients except 2 could be

FIGURE 1. Number of redo procedures.

successfully rehabilitated to New York Heart Association I or II. Two patients required prolonged care for severe heart failure and multimorbidity, respectively (Table 4).

In the long-term follow-up, all patients are still alive and demonstrated complete thrombosis/obliteration of the false lumen, and aortic diameters remained stable (Figure 2). Further aortic interventions were necessary in 2 patients. Patient 13 had severe graft infection and first underwent redo replacement of the ascending aorta for suture line rupture; 17 months later, this patient underwent a second redo operation with re-replacement of the ascending aorta and arch for a further rupture of the ascending aorta (Figure 3). Patient 10, who had a stent fixed to the elephant trunk of the descending aorta, required revision of the stent.

DISCUSSION

Optimal surgery for acute type A aortic dissection is still a matter of debate. There are several surgical approaches to the problem, all of which are associated with intrinsic difficulties. In the United States and Europe, where the patients are more obese, many surgeons favor limited surgery with reconstruction of the aortic arch under the premise “survival first,” whereas in Asia, with its smaller people, a more comprehensive surgical technique also regularly replacing the aortic arch is dominant. In the presented patient cohort, less extended surgery with preservation of the aortic arch was performed if the entry of the dissection was located in the ascending aorta, that is, the endothelial layer of the arch was intact. The dissected layers of the aortic arch (and aortic root) were approximated with Teflon-felt reinforced continuous sutures or GRFG glue. These 2 technical variants are well-established surgical procedures, but the question remains as to how the repaired aortic arch performs in the long-term.

Our patients were regularly seen on an outpatient basis with repetitive CT scans following a standardized follow-up protocol. During the follow-up, different pathologies developed necessitating redo aortic surgery: (1) Progressive dilatation of the dissected remaining native aorta,

TABLE 2. Initial aortic procedure and indication for redo surgery

No.	Initial aortic procedure	Consecutive cardiovascular procedures	Time interval to redo surgery (mo)	Aneurysm size (mm)	Indication for redo surgery	euroSCORE
1	AAR		3	30	Graft infection + endocarditis	36.0
2	AAR		3	32	Graft infection	4.6
3	AAR		97	70	Descending aorta suture line dehiscence	7.1
4	AAR	CABG	84	44	Graft infection + AA suture line dehiscence	13.0
5	MCT		108	70	Progressive false lumen/arch aneurysm	7.2
6	AAR		114	61	Progressive false lumen/arch + aortic root aneurysm	23.5
7	AAR + HAR		17	60	Progressive false lumen/arch aneurysm	7.1
8	AAR		3	53	Progressive false lumen/arch aneurysm and descending aorta	7.1
9	MCT		69	72	Progressive false lumen/arch aneurysm and descending aorta	30.6
10	AAR + ArchR + ET		5	77	Progressive false lumen/arch aneurysm and descending aorta	1.7
11	AAR		2	76	Graft infection + AA suture line dehiscence	10.0
12	Yacoub repair	AVR	87	66	Progressive false lumen/arch aneurysm and descending aorta	4.5
13	AAR + AVR	Redo archR + stent graft descending aorta	30/47	46	Graft infection + AA suture line dehiscence	14.5
14	MCT		96	58	AA suture line dehiscence	32.5
15	AAR		214	58	AA suture line dehiscence	7.5
16	AAR + AVR + ArchR	Patch repair distal arch	32	100	Aortic arch/descending suture line dehiscence	14.5
17	AAR		173	78	AA suture line dehiscence	4.1
18	MCT		117	66	Aortic arch suture line dehiscence	10.4
19	AAR + HAR	Stent graft descending aorta	65	67	Progressive false lumen/arch aneurysm and descending aorta, AV incompetence, CAD	9.1
20	AAR		12	58	AA suture line dehiscence	10.3
21	AAR		100	54	Aortic arch suture line dehiscence	11.2
22	AAR + HAR		79	63	Progressive false lumen descending aorta	12.9
23	MCT		71	62	Progressive false lumen/arch aneurysm	18.5

AA, Ascending aorta; AAR, ascending aorta replacement; AVR, aortic valve replacement; euroSCORE, European System for Cardiac Operative Risk Evaluation; MCT, mechanical valved conduit; HAR, hemiarch replacement; ArchR, total aortic arch replacement; ET, elephant trunk; CABG, coronary artery bypass grafting.

predominantly of the false lumen, was seen in 43% of patients. The false lumen usually is fed antegradely, that is, immediately at the distal anastomotic line of the implanted prosthesis. The antegrade flow constantly exposes the weakened aortic wall to the high systemic blood pressure, ultimately widening the wall. A remarkable observation was that the dimensions of the dissected native aorta may remain constant for years and then increase for no obvious reason, perhaps triggered by hypertonic episodes. (2) Suture line ruptures were as frequent as the false lumen enlargement. These late complications are well known from aortic

surgery and not limited to patients with aortic dissection.¹⁰ Especially in patients with aortic root replacement, the coronary buttons may tear off with time.¹¹ In our patient cohort, suture line ruptures were mostly located at the distal suture line of the aortic Dacron prosthesis, but also seen proximally. A huge perigraft hematoma reaching the sternum was present infrequently, hindering immediate sternal access. These patients did not exhibit significant enlargement of the remnant aorta. The reason for suture line dehiscence was evident in only 30% of patients who presented with graft infection. These cases were particularly

TABLE 3. Surgical redo procedures

	Priority	Redo procedure	Concomitant procedure	Arterial cannulation	Extracorporeal circulation (min)	Crossclamp (min)	Circulatory arrest (min)	Selective cerebral perfusion (min)
1	Emergency	Bioconduit		Femoral	292	125	0	0
2	Urgent	AAR		femoral	247	97	0	0
3	Urgent	AAR + ArchR + ET	Stent in descending aorta	Subclavian	212	169	70	32
4	Urgent	Homograft root + AAR + ArchR	CABG	Femoral	297	185	65	53
5	Urgent	AAR + ArchR		Femoral	149	89	37	27
6	Elective	MCT + ArchR		Aorta	207	151	66	47
7	Elective	HAR		Aorta	99	56	32	23
8	Urgent	AAR + FET		Aorta	242	215	103	99
9	Elective	FET		Subclavian	144	80	80	57
10	Elective	Patch repair distal arch	Stent in descending aorta	Aorta	184	68	68	41
11	Emergency	MCT	CABG	Femoral	309	140	25	20
12	Elective	AAR + FET		Aorta	179	128	86	74
13	Emergency	1. AAR + Arch 2. AAR + Arch		Femoral femoral	160	65	65	26
14	Elective	AAR		Subclavian	97	66	0	0
15	Urgent	AAR		Aorta	61	27	0	0
16	Emergency	AAR + FET		Femoral	186	186	90	78
17	Elective	AAR + HAR		Subclavian	169	77	37	20
18	Emergency	AAR + HAR		Femoral	166	93	47	40
19	Elective	MCT	CABG	Aorta	301	117	45	21
20	Urgent	AVR + AAR + HAR		Subclavian	385	203	33	33
21	Urgent	HAR		Subclavian	72	36	19	17
22	Elective	AAR + FET		Subclavian	206	110	85	80
23	Elective	AAR + FET		Subclavian	201	117	85	78

AAR, Ascending aorta replacement; AVR, aortic valve replacement; MCT, mechanical valved conduit; HAR, hemiarch replacement; ArchR, total aortic arch replacement; ET, elephant trunk; FET, frozen elephant trunk (Jotec Evita open); CABG, coronary artery bypass grafting.

challenging because the extent of infection could not be adequately judged during surgery, and thus complete eradication of infection was virtually impossible. (3) An aortic root problem was far less common. Isolated aortic valve replacement or implantation of a mechanical or biological valved conduit was performed in only 26% of cases. Half of the patients had graft infection, and an involvement of the native aortic valve was evident or assumed. Our overall reoperative incidence of 10.0% was comparable to that of Geirsson and colleagues,⁶ who reported on aortic reoperations in 10.8% cases after type A dissection.

The indication for redo surgery was established in case of progressive aortic enlargement, development of a false aneurysm/rupture, proven graft infection, or aortic valve incompetence, but not in the mere presence of a persisting false lumen in the aortic arch. Because these surgical procedures are considered to be high risk and a last resort, there are no general indications for redo surgery with regard to the aneurysmal growth. Although we establish the indication for redo surgery if the maximal diameter exceeds 5.5 cm in the ascending aorta and 6 cm in the descending aorta, others wait for greater than 6.5 cm or a yearly growth rate of greater than 0.75 cm.⁶

Only 3 patients were unsuitable candidates for redo surgery because of advanced age or comorbidity. Of note, all are still alive at a follow-up of 2 years. The assumed considerable risk for the second surgical procedure allowed us to choose a presumed safe surgical technique. Accordingly, most patients were connected to the aortic line of the extracorporeal circulation via the right subclavian or a femoral artery before sternotomy. After right atrial cannulation for the venous line and initiation of extracorporeal circulation, the patients were cooled to 20°C. Aortic arch surgery was performed with continuous cerebral perfusion via the subclavian artery and clamping the brachiocephalic trunk and left carotid artery. Additional perfusion via the left carotid artery was only initiated when the near-infrared spectroscopy system suspected left-sided hypoperfusion of the brain. If the subclavian access was not used, balloon catheters were placed into the orifices of the head vessels. We did not see the necessity of carotid cannulation and perfusion, as has been proposed by Mohammadi and colleagues.¹⁰ They reported a rupture rate of 32% during sternum reentry and a mortality rate of 17.2%. Instead of such an extensive safety net, we rely on bifemoral cannulation and hypothermia in respective patients. We noted

FIGURE 2. Kaplan–Meier survival after primary surgery for acute type A dissection (n = 228) and after late redo surgery (n = 23).

reentry ruptures in only 13% of patients and had a low mortality rate.

The false lumina of the descending aorta and the cerebral vessel island were obliterated with a running suture before

implantation of a tubular prosthesis or stent graft. More recently, hybrid stent graft placement (frozen elephant trunk) has become the favorite technique. This surgical procedure unites conventional aortic arch replacement with an

TABLE 4. Postoperative course

	Survival	Drainage loss (mL)	Revision for bleeding	Intubation (h)	Cerebrovascular accident	Vocal cord injury	Intensive care unit stay (d)	Hospital stay (d)	NYHA at discharge	Further interventions
1	Yes	1500		30			7	30	I	
2	Yes	100		36			5	50	I–II	
3	Yes	1500		120			12	24	I	
4	Yes	900		24			4	14	II	Coronary angiography
5	Yes	600		9			2	15	I	
6	Yes	970		192			16	31	I	
7	Yes	900		12			2	8	I	
8	Yes	3570	2×	240		Yes	16	39	I	Resternotomy (day 14 to late tamponade)
9	Yes	2200	1×	1296		Yes	53	57	III	
10	Yes	3940	1×	168		Yes	9	17	I	Stent re-replacement
11	Yes	130		41			4	12	I	
12	Yes	1700		20			4	15	I	
13	Yes	400		10			3	8	I	
14	Yes	550		8			2	15	I	
15	Yes	650		15			2	39	I	
16	Yes	600		70			2	25	III–IV	Coronary angiography
17	Yes	1650		4			7	25	I–II	
18	Yes	1000		33			3	16	I	
19	Yes	1030		44			5	5	n/a	ECMO for low output
20	Yes	2000	1×	96			8	15	I	
21	Yes	300		145	1×	Yes	11	13	II	
22	Yes	600		25		Yes	5	9	I	
23	Yes	3895	1×	119		Yes	8	15	I	

NYHA, New York Heart Association; ECMO, extracorporeal membrane oxygenation; n/a, not available.

FIGURE 3. Aortic rupture after separate replacement of the aortic valve and ascending aorta and stenting of the descending aorta (patient 13).

antegrade stent placement into the descending aorta. The true lumen is stabilized with the covered stent while the false lumen is proximally occluded and progressively obliterated. It further enables the interventionalist to connect further endovascular stents in the descending aorta. Tsagakakis and colleagues⁹ confirm the superiority of this technique in a newly generated international registry with a thrombosis rate of the false lumen of 93% (complete 76%). Standard total arch replacement was not considered an option because it leaves the descending aorta untreated, unless there is no reentry or an elephant trunk procedure is added. A further option could be routine stent graft placement to cover the distal reentry site, but this was not our policy.

All redo procedures were straightforward without significant technical difficulties. The outcome in this small series was good and compares favorably to the sparse literature, in which mortality rates up to 41% have been reported.^{6,9,10,12,13} In view of the comorbidities of our patient cohort, we therefore continue to advocate a simple and fast emergency operation in case of acute type A dissection, that is, resection of the intimal tear and replacement of the ascending aorta with an open distal anastomosis. Total arch repair remains reserved for patients with extensive aortic arch pathologies. The stent graft proved to be a highly effective and elegant technique for the redo procedures because it also offered a safe way to place further endoluminal stents into the descending aorta. In contrast, conventional elephant trunk prosthesis did not always allow a secondary endoluminal stent to be securely anchored.

Our late findings after aortic surgery for acute type A dissection underline the importance of a long-term follow-up, certainly well more than 5 years after surgery, because the average time interval for redo surgery was approximately

6 years after the initial procedure. This is especially true for patients with Marfan syndrome.^{10,14,15} Similar observations have been made by Mohammadi and colleagues,¹⁰ Bachet and colleagues,¹² and Pugliese and colleagues,¹⁶ who reported time intervals between repair and reoperation of more than 60 months. A yearly imaging of the aorta is warranted to detect these complications early, by CT or magnetic resonance imaging. The problem of persisting dissection in the aortic arch stimulates the discussion on whether the aortic arch should always be replaced during the initial procedure. Protagonists point out similar mortality rates with aggressive surgical approaches.¹⁷⁻¹⁹ We and others observed a low reoperative rate and do not recommend the latter, but we want to emphasize the importance of obliterating the false lumen of the aortic arch, for example, with tissue glue or suture.^{4,6} We observed no aortic root necrosis due to inadequate application of GRFG glue.²⁰ However, because a significant number of patients were lost to follow-up after the initial repair of acute type A dissection, our results may be influenced by underreporting the need for a second surgical procedure.

CONCLUSIONS

Persistent dissection is an ongoing disease despite proximal repair, potentially mandating a subsequent operation. Therefore, a long-term follow-up is obligatory. Whether a more aggressive approach during the initial procedure (ie, arch replacement) is indicated to prevent late complications is still under debate, particularly considering that this complication does not develop in all patients. The operative strategy should be based on individual findings, and the extent of the primary repair must be weighed against the operative risk. When a second operation is necessary in patients, our data indicate that this can be safely done.

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