Risk of late reoperations in patients with acute type A aortic dissection: impact of a more radical surgical approach

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Abstract

Objective: To evaluate the incidence and risk factors for reoperations on the pre-isthmic aorta after repair of type A acute aortic dissection.

Methods: From January 1979 to December 1996, 178 patients (125 males and 53 females with a mean age of 57 ± 9 years) underwent emergency surgery for acute type A aortic dissection with an overall operative mortality rate of 21%. One hundred and forty-one patients (100 males and 41 females, aged 58 – 12 years), were discharged after successful replacement of the ascending aorta in 136 cases (96%) with extension to the transverse arch in 22 (16.2%) and associated total root or aortic valve replacement in 31 (22.8%) and 6 (4.4%) cases, respectively. Intimal tear resection and direct primary anastomosis of the aorta were performed in 5 patients (4%). Total follow-up was 690 patient-years, mean 5.1 – 4.1 years, with an actuarial survival rate at 5, 10 and 15 years of 88%, 73% and 42%, respectively.

Results: Nineteen patients (13%), 13 males and 6 females, aged 50 – 10 years, required a total of 22 reoperations with an actuarial freedom from reoperation at 5, 10 and 15 years of 94%, 64% and 35%, respectively. Initial repair consisted of replacement of the ascending aorta in 16 (84%) cases, with total root replacement in 2 (12%) and isolated aortic valve replacement in 1 (6%). Three patients (16%) were treated by intimal tear resection and direct primary anastomosis of the aorta. Mean interval between initial repair and reoperation was 5.2 – 3.1 years and indication to re-do surgery were severe aortic regurgitation in 2 (11%), aneurysmal evolution of the false lumen in 4 (21%) or both in 13 (68%). Extensive aortic reconstruction comprising simultaneous graft replacement of the aortic root, ascending aorta and aortic arch was necessary in 13 cases (68%), isolated replacement of the ascending aorta in 3 (16%), aortic valve in 2 (11%) and aortic arch in 1 (5%). There were 1 hospital (5%) and 2 late (11%) deaths at a mean follow-up of 2.5 – 2.4 years, with an actuarial survival at 5 years of 88%. Retrospective analysis of our total experience revealed that the introduction of the open distal anastomosis technique since 1990, reduced the incidence of reoperation from 11/46 (24%) to 8/95 (8.4%) (P, 0.05). However, also with this strategy 8/73 (11%) patients surviving replacement limited to the ascending aorta required reoperation versus none of the 22 patients surviving repair extended to the aortic arch. Three out of 5 (60%) patients undergoing intimal tear resection and primary anastomosis of the aorta early in our experience, required reoperation. Conclusions: Management of patients with acute type A aortic dissection may include one or more surgical procedures after the initial emergency repair. Reoperations carry a low operative risk with good long-term survival and their incidence is reduced by routine open distal anastomosis and aggressive replacement of the aortic arch. Intimal tear resection and primary anastomosis of the aorta appear to be associated with increased risk of reoperation. © 1998 Elsevier Science B.V. All rights reserved

Keywords: Aortic surgery; Acute aortic dissection; Reoperation; Circulatory arrest

1. Introduction

Acute Stanford type A aortic dissection is a surgical emergency having a very poor prognosis in unrecognized or untreated patients with an early mortality rate of 1%/h in the first 48 h [1–3]. Advances in diagnosis, increased surgical experience and improvement in surgical techniques and perioperative management, have reduced the hospital mortality rate in more recent years [4–6]. Nevertheless, emergency procedures have been primarily directed at prevention of aortic rupture and therefore generally limited to
the proximal ascending aorta, thus leaving diseased and often dissected aorta both proximally and distally to the replaced segment. The necessity of a more aggressive approach with replacement of the dissected aortic arch has been recently suggested to reduce the incidence of late reoperations [7–9]. This retrospective analysis was undertaken to identify possible risk factors correlated with reoperations in the segments of the aorta approached at first repair.

2. Materials and methods

Between January 1979 and December 1996, 178 patients underwent emergency surgery for acute Stanford type A aortic dissection. Dissection was considered acute when treated within 14 days from the onset of symptoms. All clinical data were obtained by retrospective review of hospital records, and postoperative follow-up was obtained by telephone communication and was complete in 99.3% of patients. There were 125 males and 53 females with a mean age of 57 ± 9 years (range, 18–88 years). One hundred and thirty-six patients (76.4%) underwent emergency operation within the first 24 h from the onset of pain. Employed surgical procedures are listed in Table 1. No patients were treated by complete replacement of the aortic arch. Mean cardiopulmonary bypass (CPB) and aortic cross-clamp (AoX clamp) times were 171 ± 53 min and 87 ± 30 min, respectively. Circulatory arrest (CA) to perform an open distal anastomosis was employed in 114 (64%) patients for a mean time of 20 ± 19 min. The overall hospital mortality rate was 20.7% and did not differ in patients treated within the first 24 h or requiring replacement of the transverse aortic arch (Table 1). The 141 discharged patients (100 males and 41 females, with a mean age of 57 ± 12 years) were followed for a total of 690 patient-years, respectively (range, 24–57), respectively (Table 2).

Since 1990 a more radical surgical approach was introduced, consisting of complete replacement of the ascending aorta from the sinotubular junction up to the transverse aortic arch if an additional tear was discovered during the circulatory arrest period. To analyze the impact of this more radical surgical approach on late reoperations, survivors were divided into 2 groups with Group 1 (G1 = 46 patients) including patients undergoing a more conservative approach both at proximal and distal segments of the ascending aorta, and Group 2 (G2 = 95 patients) including those patients treated with a more radical approach at the proximal segment of the ascending aorta and using circulatory arrest for the open distal anastomosis (Table 3).

Patients operated on since 1990 were followed on a yearly base with 2D echocardiography and intravenous digital subtraction angiography. Indications to reoperation were aortic root or arch aneurysms, pseudoaneurysms and severe aortic regurgitation.

2.1. Surgical technique

2.1.1. First repair

Surgical techniques have substantially evolved over this 18 years of experience. Femoral artery cannulation, median sternotomy and right atrial cannulation for total CPB were standard procedures. The ascending aorta was cross-clamped and incised and high potassium cold cardioplegic arrest was obtained with crystalloid St. Thomas II and more recently with blood cardioplegia infused into the coronary ostia. Deep hypothermic circulatory arrest (18°C) for exploration of the aortic arch and open distal anastomosis was sporadically used at the beginning of our experience and became routine since 1990. Intimal tear resection and direct aortic reconstruction was employed in 7 patients (4%), early on in our experience, being abandoned since 1990. In the other 171 patients, the segment of aorta containing the intimal tear was resected and replaced with a Dacron prosthesis. With the use of the open anastomosis technique, a more radical approach was associated which included complete resection of the ascending aorta from the sinotubular junction up to the transverse aortic arch if an additional tear was discovered during the CA period. Both proximal and distal aortic stumps were prepared approxi-
mating the two aortic layers with continuous sutures but-
tressed on an outer band of Teflon felt. Since 1993, prepara-
tion of the aortic stumps also included complete obliteration
of the entire space between the dissected layers with appli-
cation of French glue (43 patients; 24%). As a result of the
radical excision, preparation of the proximal segment
resulted in remodeling of the aortic annulus and support to
the valve commissures, thus correcting aortic regurgitation.
Nevertheless, aortic valve or total root replacement with a
composite graft were necessary in patients with a diseased
aortic valve, anuloaortic ectasia or in cases with destruction
of the sinus of Valsalva by the dissection.

2.1.2. Reoperation

Median sternotomy was always performed after femoral
artery cannulation and CPB instituted via the right atrium
with a single-stage venous cannula. Cardiac arrest was
obtained with blood cardioplegia infused in the aortic root
or directly in the coronary ostia if aortic regurgitation was
present. Retrograde blood cardioplegia was always added in
most recent cases. In patients with recurrent pathology of
the proximal aortic segment, complete excision of the aortic
tissue was followed by total root replacement with a com-
posite graft and reimplantation of the coronary arteries
using the button technique [10]. In patients requiring repla-
cement of the aortic arch, the distal anastomosis and reim-
plantation of the head vessels were performed during deep
hypothermic CA. When long periods of CA were predicted,
cerebral protection was obtained by selective perfusion of
the common carotid arteries through a cervical approach. In
patients with associated aneurysmal evolution of the aortic
arch and descending aorta, the elephant trunk technique was
employed [11].

2.2. Statistical analysis

Continuous data are expressed as mean ± 1 standard
deviation. Differences between categoric parameters were
assessed by the chi²-test or Fisher’s exact test. Actuarial sur-
vival and event-free estimates were generated by the
Kaplan–Meier method with variability expressed with
70% confidence limits (CL). Fifteen specific variables
including year of operation, operation within the first 24 h
from the onset of symptoms, sex, age, systemic hyperten-
sion, preoperative neurologic deficits, Marfan syndrome,
cardiac tamponade, shock, use of circulatory arrest, use of
radical surgical technique, site of intimal tear, presence of
aortic regurgitation, preoperative cardiac procedures and
type of first operation, were analyzed univariately. A P-
value less than 0.05 was considered to be statistically sig-
nificant.

3. Results

Nineteen of the 141 discharged patients (13%) required
reoperation on the pre-isthmic aorta. All patients were elec-
tively reoperated and 3 of them required an additional
operation for prosthetic aortic valve dysfunction due to pan-
nus growth in 1, and to progressive aneurysmal evolution of
the distal false lumen in 2. There were 13 males and 6
females with a mean age of 50 ± 10 years. Actuarial free-
dom from reoperation for all survivors at 5, 10 and 15 years
was 94% (CL = 90–96), 64% (CL = 55–71) and 35%
(CL = 25–48), respectively (Fig. 1). Mean interval between
initial repair and reoperation was 5.2 ± 3.1 years and indi-
cation to re-do surgery were severe aortic regurgitation in 2
(11%), progressive aneurysmal evolution of the false lumen
in 3 (16%) or both in 13 (68%). One patient (5%) required
reoperation for pseudoaneurysm formation at aortic graft
suture lines after composite graft replacement with the Cab-
rol technique. The type of surgical procedures at first repair
and reoperation are shown in Fig. 2. Mean CPB and AoX
clamp times were 198.6 ± 39.4 and 88.7 ± 50.2 min,
respectively. Cerebral protection during replacement of
the aortic arch was obtained by deep hypothermic CA in
11 patients (78.6%; mean time: 28 ± 9.2 min) and by selec-
tive cerebral perfusion via direct common carotid artery
cannulation in 3 patients in whom longer periods of CA
were predicted (21.4%; mean time of CA: 69.3 ± 18.5 min).

Table 3

<table>
<thead>
<tr>
<th>Type of procedure</th>
<th>Patients n (%)</th>
<th>G1 (46 patients)</th>
<th>G2 (95 patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intimal tear resection</td>
<td>5 (3.5)</td>
<td>5 (100)</td>
<td>0</td>
</tr>
<tr>
<td>Asc. Ao</td>
<td>78 (55.3)</td>
<td>31 (39.7)</td>
<td>47 (60.2)</td>
</tr>
<tr>
<td>Asc. Ao + arch</td>
<td>21 (14.9)</td>
<td>0</td>
<td>21 (100)</td>
</tr>
<tr>
<td>Asc. Ao + root</td>
<td>30 (21.2)</td>
<td>7 (23.3)</td>
<td>23 (76.7)</td>
</tr>
<tr>
<td>Asc. Ao + root + arch</td>
<td>1 (0.8)</td>
<td>0</td>
<td>1 (100)</td>
</tr>
<tr>
<td>Asc. Ao + AV</td>
<td>6 (4.2)</td>
<td>3 (50)</td>
<td>3 (50)</td>
</tr>
</tbody>
</table>

Asc. Ao, ascending aorta.

Fig. 1. Actuarial freedom from reoperation of the 141 discharged patients.
There was 1 (5%) hospital death due to cardiogenic shock in a patient requiring total replacement of the aortic arch and myocardial revascularization. The 18 discharged patients were followed up for a mean time of 2.5 ± 2.4 years. There were 2 (11%) late deaths due to rupture of the descending aorta and sepsis, respectively. The overall actuarial survival at 5 years was 88% (CL = 85–91).

Univariate analysis of possible risk factors for reoperation revealed that intimal tear resection with direct aortic anastomosis and replacement of the ascending aorta using a more conservative approach (G1 patients), were associated with a significant increased risk (P < 0.01).

Indeed, 3 out of 5 (60%) survivors who underwent intimal tear resection at first repair required reoperation (P < 0.01). Eleven (24%) out of 46 G1 patients, operated on with a more conservative approach, were reoperated versus 8 (8.4%) of the 95 G2 patients who underwent a radical excision of the diseased aorta (P = 0.017). None of 22 G2 patients who required transverse arch replacement for an additional tear in the aortic arch required reoperation versus 19 of 119 (16%) patients surviving replacement limited to the ascending aorta (P = 0.00001).

4. Discussion

Early diagnosis and referral as well as refinements in surgical and medical strategies have reduced hospital mortality after emergent operation for acute Stanford type A aortic dissection [3–6,12]. Nevertheless, persistence of dissection in the untreated segments of the aorta influences follow-up mortality and necessity of late reoperation, thus rendering surgery essentially palliative [13–16,21].

Although it seems to be inevitable that some patients will require reoperations for problems related to the distal residual dissected aorta, failure of repair in the pre-isthmic tract may theoretically be prevented.

Several surgical options have been used for emergency repair, ranging from more conservative to aggressive techniques [7–9,17,18]. Some authors have proposed intimal tear resection and conservative reconstruction of the ascending aorta as a simple and safe method [17,18]. However, despite acceptable early morbidity and mortality, long-term results with this technique are not available in large series [17,18]. We used this approach in 7 patients early on in our experience when intraoperative and early postoperative bleeding were major concerns. Despite acceptable early mortality for that era, this technique carried a significant higher risk of late reoperations with 60% (3/5) of long-term survivors requiring replacement of the ascending aorta for progressive aneurysmal evolution of the false lumen.

More aggressive technical strategies evolved during the years and focused both on proximal and distal segments of repair with the aim of reducing the necessity of reoperation in the pre-isthmic aorta [7–9,19,20]. Some authors have clearly demonstrated that the native aortic valve and aortic root can be saved with a low risk of recurrent aortic insufficiency [19,20]. The present study confirms that the aortic valve can be preserved in the majority of patients with only 2 out of 19 patients (10.5%) requiring reoperation for isolated aortic regurgitation. However, preservation of the aortic valve is safe if the aorta is resected down to the sinotubular junction in order to allow removal of a greater portion of the dissected layers and resuspension of the aortic annulus and commissures. In fact, a more conservative proximal approach, used in the majority of our patients operated on before 1990, resulted in a significant increased risk of reoperation. Eleven out of 19 (57.9%) reoperated patients in our series developed severe aortic regurgitation secondary to aneurysmal evolution of the proximal ascending aorta and the majority of them were operated on in the first part of our experience when proximal radical excision was not applied.

Up to 15–20% of patients with acute type A dissection have an intimal tear in the transverse aortic arch and controversies exist regarding the best surgical treatment for such patients [7–9]. Some authors found that resection of intimal tear was not associated with a lower risk of late reoperations while others have suggested that transverse arch replacement was associated with a less frequent aneurysmal evolution of the dissected arch, without increasing in-hospital mortality [5–9]. Since 1990 we routinely adopted the open anastomosis technique with replacement of the transverse aortic arch, if an additional intimal tear was discovered. This approach did not increase early mortality also in our series and was associated with a significant lower rate of reoperations. In fact, none out of 22 patients who underwent transverse arch replacement required reoperation versus 19 out of 119 (16%) patients surviving replacement limited to the ascending aorta.

Incidence of late reoperations after repair of acute type A aortic dissection ranges between 7 and 20% [3,4].

In the series reported by Bachet and associates, 29 of 42 (70%) procedures involved the pre-isthmic aorta, thus confirming that failure of the proximal repair is a major cause of
late reoperations [16]. These authors found that Marfan syndrome and no arch replacement were significant risk factors. In our experience Marfan syndrome did not increase the risk of reoperation and this was possibly due to its low prevalence with only 9 patients out of 141 survivors.

The mean time interval between repair and reoperation was 65 ± 20 months in Bachet’s experience and 62 ± 37 months in the present study. All of our patients underwent reoperation in the last 5 years and the interval was longer for patients operated on before 1990. We believe that a more careful follow-up of discharged patients in the recent years together with increased experience in aortic surgery have possibly changed indications for reoperation during the study period with timely reintervention in the most recent years. This fact, may probably also affect the reliability of the actuarial freedom from reoperation, which is presented in Fig. 1.

Careful postoperative follow-up allows early identification of potentially lethal complications permitting elective reoperation with an acceptable mortality rate [13,14,21]. Emergency surgery was the only determinate risk factor of death in the previously reported series. In our experience all patients were reoperated on electively and early mortality compares favorably with the 6.2% for each elective procedure in Bachet’s report.

In conclusion, a more radical surgical approach at both proximal and distal segments of the pre-intrinsic aorta may prevent failure of emergent repair. Careful follow-up of these patients allow elective reoperation with an acceptable mortality.

References


Appendix A. Conference discussion

Dr M. Turina (Zurich, Switzerland): I have noticed that you have expanded your indications for type A. What were the contraindications for acute type A in this study?

Dr Santini: Crucial complications of acute type A aortic dissection like a major neurological event, myocardial infarction with cardiogenic shock or visceral ischemia, often due to delayed patient referral, represented contraindications for repair. More recently we operated on more patients possibly just because we got them earlier, before the establishment of these very crucial complications.

Dr C. Alhan (Istanbul, Turkey): Did false lumen patency rates differ among two groups in patients who underwent reoperation versus did not?

Dr Santini: I do not have the exact figure, but definitely, during the second period, in our experience the more aggressive approach, which
involved always an open distal anastomosis and sometimes arch replacement, excluding the intimal tear at the arch level. which in our series is approaching between 25% and 30% of our patients, I think contributes to exclude the patency of the false lumen in the second group.

Dr Turina: Do you have the data about patency of the false lumen in the descending aorta in this later group?

Dr Santini: I don’t have the exact figure really.

Dr R. Dion (Brussels, Belgium): At a previous meeting of this Association in Paris, Dr. Ergin meant that it was better to remove all the dissected tissue in the ascending aorta and advised not to repair the aortic valve but rather to perform a radical Bentall operation. We had a different opinion at the time and we have resuspended the aortic valve in about 15 patients with excellent immediate echocardiographic results. Unfortunately, we had to reoperate on 4 of these patients at a postoperative interval of 10 months to 18 months. Nowadays, either we would apply the Bentall procedure or preferably a Yacoub or Tirone David operation, to eliminate all the diseased components of the aortic root. What is your perception about that particular point?

Dr Santini: I think that as far as the aortic root is concerned, a more aggressive approach is definitely justified when we are dealing with a Marfan patient, for example. I think it is out of the question that in this case we should be very aggressive and just proceed with Bentall type of operation, and we have done that in the last years. In other cases I think that a more aggressive approach can give you an excellent exposure on aortic root remodeling. I think it is very crucial to take the tissue out down to the sinotubular junction and resuspend the aortic valve commissure. Indeed, in our series, we had only 2 patients that required reoperation later on in our follow-up for aortic regurgitation. Definitely we are committed to follow up with these patients; and in fact, every 6 months we are performing trans-esophageal echocardiography just to check on the degree of regurgitation and the left ventricular diameter.

Dr S. Westaby (Oxford, UK): We have a little difference of opinion, because I think the prime object of aortic dissection repair is to have a surviving patient at the end of it. And the operative mortality for radical surgery versus root repair with glue is very different. And I think increasingly it is apparent that the glue repair is durable.

Dr J. Buchet (Suresnes, France): I just want to say that your experience is exactly similar to ours concerning the number of patients operated on and reoperated on. We have now operated on 193 patients with acute type A dissection and reoperated 23 patients in this group. The only thing that surprises me a little in your experience is that you had no patients reoperated on because of thoracoabdominal evolution of a persisting dissection. And this makes a big difference with our experience, as those patients were the major group at risk. In this group of patients reoperated on because of a thoracoabdominal aneurysm the mortality rate was 25%. So how can you explain that you did not have to reoperate on patients with thoracoabdominal chronic dissection in your experience?

Dr Santini: Indeed, five patients in our series presented thoracoabdominal evolution of a persisting dissection. Two of them were reoperated on with a thoracoabdominal aneurysm with no mortality. Another patient died after the first stage of an elephant trunk procedure while waiting for distal repair. Finally, two other patients are currently scheduled for repair. Moreover, we had 4 deaths, and unfortunately, these patients had not been autopsied. So we cannot exclude that these deaths were indeed related to persistent disease of the thoracoabdominal aorta. This is why we are now very committed in doing the follow-up ourselves instead of leaving others doing it.