Is preservation of the aortic valve different between acute and chronic type A aortic dissections? 

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Abstract

**Objectives:** In repair of acute type A aortic dissection, the type of proximal repair of the ascending aorta has been of great interest; however, very few reports are available regarding this issue in chronic aortic dissection. The surgical strategies for proximal repair in chronic dissection may not be the same as those for acute dissection. We reviewed our 10-year experience of both acute and chronic type A aortic dissections in order to elucidate the validity of valve preservation and the long-term results of aortic regurgitation (AR). **Methods:** From 1990 to 1999, 93 patients (55 acute and 38 chronic dissections) underwent operation for type A aortic dissection. Five Marfan patients were included in each group. The degree of AR was evaluated by echocardiography before and after (at hospital discharge and late follow-up) operation. **Results:** In acute type A aortic dissection (n = 55), 16 patients had AR grade II or greater (29%), of whom seven had AR grade III (13%). In 29 patients, dissection was found below the sinotubular junction (STJ) and 14 patients had AR grade II or greater (48%). The aortic valve was replaced in eight patients (21% vs. 7% in acute dissection; P = 0.043). The aortic valve was replaced in eight patients (21% vs. 7% in acute dissection; P = 0.051), including three Marfan patients. Of those whose aortic valve was preserved (n = 30), two patients required reoperation for severe AR. The freedom from postoperative AR grade III or greater was 89% at 5 years for operative survivors with acute dissection and 92% for those with chronic dissection, respectively. **Conclusions:** This retrospective study suggests that preservation of the aortic valve in acute type A aortic dissection is feasible in non-Marfan patients regardless of the degree of AR. In chronic dissection, aortic root replacement needs to be considered when the degree of AR is greater than moderate because of a dilated STJ and/or annulus. In both acute and chronic dissections, satisfactory mid-to long-term results with a low incidence of reoperation were obtained in those whose aortic valve was preserved. © 2001 Elsevier Science B.V. All rights reserved.

**Keywords:** Type A aortic dissection; Acute dissection; Chronic dissection; Aortic regurgitation; Marfan syndrome; Gelatin–resorcin–formalin glue

1. Introduction

In repair of aortic dissection involving the aortic root, the type of proximal repair of the ascending aorta has been of great interest and it is still debated whether the aortic valve has to be replaced or preserved. Many authors have reported the issue of aortic valve preservation in acute type A aortic dissection and the rates of valve replacement reported in the literature range from 0 to 43% [1–9]. The wide range of rates of valve replacement is mainly due to the difference in the strategy employed by each surgeon. Thus, some authors advocate an aggressive approach to aortic pathology with Bentall type operations [3,6,8], while others [2,5,7] emphasize the advantages gained by preserving the aortic valve and root with classical techniques and the safety and simplicity of such techniques, and the low percentage of residual or recurrent aortic regurgitation (AR).

In contrast to acute type A aortic dissection, very few reports [1,10] are available regarding this issue in chronic type A aortic dissection. In chronic dissection, the sinotubular junction (STJ) and/or aortic annulus can be more
enlarged and the aortic valve leaflets could be elongated due to long-standing AR, so the surgical strategy for AR due to chronic type A aortic dissection would be altered as opposed to AR with acute type A aortic dissection.

We reviewed our experience in patients with both acute and chronic type A aortic dissections retrospectively to elucidate the validity of the classical repair with or without the use of gelatin–resorcin–formalin (GRF) glue and evaluate the mid- to long-term results of conservative procedures.

2. Patients and methods

From January 1990 to December 1999, 93 patients (53 men and 40 women) underwent operation for Stanford type A aortic dissection. The dissection was defined as acute if chest pain or other symptoms occurred less than 14 days earlier and chronic if more than 14 days earlier. The demographics of patients with both acute and chronic type A aortic dissections are shown in Table 1. All patient information was obtained by retrospective review of hospital records, and long-term follow-up was obtained by regular recall of the patients to our hospital or its affiliated hospitals. The current follow-up was completed in 100% of the patients and extended to 10 years (mean, 3.5 ± 3.0 years).

2.1. Acute type A aortic dissection

The mean age of patients with acute dissection was 60.7 ± 13.3 years, with a range from 29 to 83 years. There were five patients with Marfan’s syndrome (9%). The location of the primary intimal tear was determined angiographically, echographically, or by surgical findings. Type A aortic dissection resulting from retrograde propagation from a descending thoracic aortic tear (DeBakey IIIretro) occurred in one patient (2%). All patients with acute dissection underwent operations on an emergency basis. Patients routinely underwent median sternotomy, and total cardiopulmonary bypass was established with femoral artery cannulation in earlier series, whereas in recent series, cannulation with the axillary artery was chosen depending on the anatomy of the dissection. Brain protection was achieved by selective cerebral perfusion [11] and circulatory arrest was not utilized in any case. Although there was a substantial difference in the repair of the aortic arch among surgeons, our general approach to the proximal end of the ascending aorta has remained the same, to preserve the aortic valve whenever possible. Whether the aortic valve was preserved or replaced depended on the underlying disease, such as Marfan’s syndrome and annuloaortic ectasia, coexistent aortic valve disease, the degree of valvular destruction due to dissection, and the surgeon’s inclination. Before 1994, repair of the proximal end of the ascending aorta in acute dissection was achieved by careful reapproximation of the two aortic layers with continuous sutures buttressed by outer and inner layer bands of Teflon felt (n = 19) and commissure was resuspended with additional pledgetted stitches (n = 5), whereas since 1995, GRF glue has been applied (n = 28) between dissected layers to obliterate the entire space of proximal dissection.

As opposed to the repair of the proximal end of the ascending aorta where the aortic valve is preserved whenever possible, the approach to the distal end of the ascending aorta altered during a period of over 10 years of experience. Thus, a segment of the ascending aorta, containing the area of most severe injury and intimal tear (if present), was resected and replaced with a tubular Dacron graft in earlier series, whereas in recent series, replacement of the total arch concomitant with the ascending aorta was carried out with a woven graft with four branches whenever possible. Consequently, replacement of the total arch concomitant with the ascending aorta was carried out in 55% (30/55) of acute type A aortic dissections (Table 2).

2.2. Chronic type A aortic dissection

The mean age of patients with chronic dissection was 60.3 ± 12.5 years, with a range from 26 to 82 years. There were five patients with Marfan’s syndrome (13%). Type A aortic dissection resulting from retrograde propagation from a primary arch or a descending thoracic aortic tear (DeBakey IIIretro) occurred in five patients (13%).

Table 1

<table>
<thead>
<tr>
<th>Clinical characteristics&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Acute</th>
<th>Chronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number (patients)</td>
<td>55</td>
<td>38</td>
</tr>
<tr>
<td>Gender (male/female)</td>
<td>32:23</td>
<td>18:20</td>
</tr>
<tr>
<td>Mean age (years)</td>
<td>60.7</td>
<td>60.3</td>
</tr>
<tr>
<td>Median</td>
<td>64</td>
<td>64</td>
</tr>
<tr>
<td>Range</td>
<td>29–83</td>
<td>26–82</td>
</tr>
<tr>
<td>Marfan (patients)</td>
<td>5 (9)</td>
<td>5 (13)</td>
</tr>
<tr>
<td>DeBakey I</td>
<td>46 (84)</td>
<td>17 (45)</td>
</tr>
<tr>
<td>DeBakey II</td>
<td>8 (14)</td>
<td>16 (42)</td>
</tr>
<tr>
<td>DeBakey IIIretro</td>
<td>1 (2)</td>
<td>5 (13)</td>
</tr>
<tr>
<td>Preoperative shock</td>
<td>14 (25)</td>
<td>0</td>
</tr>
</tbody>
</table>

<sup>a</sup> Figures in parentheses represent percentage values.

Table 2

<table>
<thead>
<tr>
<th>Procedures performed&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Acute (n = 55)</th>
<th>Chronic (n = 38)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AsAo/hemiarch</td>
<td>24 (1&lt;sup&gt;b&lt;/sup&gt;)</td>
<td>11</td>
</tr>
<tr>
<td>AsAo + total arch</td>
<td>27</td>
<td>18</td>
</tr>
<tr>
<td>AsAo to DesAo</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>AsAo + AVR</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Bentall + total arch</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Bentall</td>
<td>–</td>
<td>3 (1&lt;sup&gt;c&lt;/sup&gt;)</td>
</tr>
</tbody>
</table>

<sup>a</sup> AsAo, ascending aorta; DesAo, descending aorta; AVR, aortic valve replacement; MVR, mitral valve replacement; CABG, coronary artery bypass grafting.

<sup>b</sup> One CABG.

<sup>c</sup> One MVR.
patients with chronic dissection underwent elective operations. The cardiopulmonary bypass, brain protection and surgical techniques in chronic type A aortic dissection were basically the same as in acute dissection. Patients routinely underwent median sternotomy, and total cardiopulmonary bypass was established with cannulations with the femoral artery, the axillary artery or ascending aorta via the left ventricular apex, depending on the anatomy of the dissection. One patient required an additional left thoracotomy (T incision) to replace the total thoracic aorta. In the repair of the proximal end of the ascending aorta, the aortic valve was preserved whenever possible. The reapproximation of the two aortic layers was carried out with continuous sutures buttressed by outer and inner layer bands of Teflon felt ($n = 19$) and the commissures were resuspended with additional pledgetted stitches ($n = 4$) when necessary. Unlike acute dissection, GRF glue was used only in a few cases ($n = 2$).

With regard to the repair of the distal end of the ascending aorta, replacement of the total arch concomitant with the ascending aorta was carried out with a woven graft with four branches when the aortic arch was enlarged. Consequently, replacement of the total arch concomitant with the ascending aorta was carried out for 58% (22/38) of patients with chronic type A aortic dissections (Table 2).

2.3. Evaluation of aortic valve regurgitation

All patients had preoperative and/or intraoperative echocardiographic examinations. Data regarding AR were obtained by retrospective analysis of transthoracic and/or transesophageal echocardiography. Postoperative evaluations at discharge and late follow-up were carried out by transthoracic echocardiography. The degree of AR was evaluated by pulse-Doppler echocardiography and/or Doppler color-flow mapping. AR was classified as grade 0–I, grade II, grade III, or grade IV.

2.4. Statistical analysis

Statistical comparisons between categorical parameters were performed by $\chi^2$ contingency analysis or Fisher’s Exact test; a $P$ value of less than 0.05 was considered significant. Survival and event-free probability estimates were determined by Kaplan–Meier actuarial analysis. The Kaplan–Meier curves were compared by the log-rank test.

3. Results

3.1. Acute type A aortic dissection

The hospital mortality rate for patients with acute type A dissection was 12.7% ($7/55$). The most common causes of hospital death were intraoperative complications related to either hemorrhage or low cardiac output (or both; $n = 5$), and the other cause was respiratory failure ($n = 2$). No hospital death was related to residual AR after operation, since postoperative transthoracic echocardiography did not show AR of greater than grade II in any case. The survival for acute dissections, as shown in Fig. 1, was 82% at 5 years.

The results of preoperative AR, the rate of aortic valve replacement and reoperation are indicated in Table 3. In acute dissection ($n = 55$), 16 patients (29%) had AR grade II or greater, of whom seven had AR grade III. The aortic valve was replaced in four patients (7%), of whom three had Marfan’s syndrome. These three Marfan patients had the Bentall procedure concomitant with total arch replacement. Only one non-Marfan patient required aortic valve replacement, because of aortic valve stenosis with a pressure gradient of 40 mmHg. One patient was noted to have annuloaortic ectasia by intraoperative esophageal echocardiography during the emergency operation; however, only the ascending aorta was replaced because of poor clinical presentation, including shock and pulmonary hemorrhage after resuscitation. At the time of discharge from hospital, three patients still had AR grade II, while at late follow-up,
AR had deteriorated to grade III in two of them. However, no reoperation has been required so far. The freedom from postoperative AR grade III or greater, as shown in Fig. 2, was 89% at 5 years for operative survivors whose aortic valves were preserved.

In 29 acute type A patients, dissection was found below the STJ and 14 patients (48%) had AR grade II or greater, of whom seven had AR grade III (Table 4). Reapproximation of the two aortic layers by the felt sandwich technique was used in seven patients and five of them required valve suspension of commissures. GFR glue was used in seven patients to repair the proximal dissection and four of them had valve suspension of commissures. The freedom from AR grade III or greater in repair with and without GFR glue in all patients with acute dissection is shown in Fig. 3. There was no significant difference between the groups, although the freedom from postoperative AR grade III or greater in the group with GFR glue was lower.

3.2. Chronic type A aortic dissection

The hospital mortality rate for patients with chronic type A dissection was 7.9% (3/28). The causes of death were intraoperative complications related to hemorrhage (n = 2) and low cardiac syndrome due to malperfusion during cardiopulmonary bypass (n = 1). No hospital death was related to residual AR after operation. The survival for chronic dissection, as shown in Fig. 1, was 77% at 5 years, which was not significantly different from acute dissection (P = 0.963).

The results of preoperative AR, the rate of aortic valve replacement and reoperation are indicated in Table 3. In chronic dissection (n = 38), 14 (37%) patients had AR grade II or greater, of whom 11 had AR grade III. Although there was no statistical significance (P = 0.051), patients with AR grade III were more frequent among those with chronic dissection than among those with acute dissection. The aortic valve was replaced in eight patients (21% vs. 7% in acute dissection; P = 0.051), including three Marfan patients, while the aortic valve was preserved in the remaining 30 patients. Of those whose aortic valve was preserved, two patients required reoperation for severe AR. One with preoperative AR grade III remained AR grade II at hospital discharge and AR deteriorated, requiring reoperation 8 years later. The other was a Marfan patient who had no AR at primary repair; however, the Bentall procedure was required 8 years later because of moderate AR. The freedom from postoperative AR grade III or greater, as shown in Fig. 2, was 92% at 5 years for operative survivors whose aortic valves were preserved.

With regard to the anatomy of dissection of the aortic root (Table 4), dissection was found below the STJ in 15 chronic type A patients and 12 patients (80%) had AR grade II or greater (vs. 48% in acute dissection; P = 0.043). The methods of repair in chronic patients with AR grades greater than II included the Bentall procedure in seven, separate AVR and replacement of the ascending aorta in one, and the felt sandwich technique in seven patients, five of whom had valve suspension of commissures.

4. Discussion

4.1. Valve preservation in acute type A aortic dissection

It is still controversial whether the aortic valve should be
preserved or replaced in acute type A aortic dissection, and
the rates of valve replacement reported in the literature
range between 0 and 43% [1–9]. Aortic pathologies that
require aortic root replacement include annuloaortic ectasia,
coexistent aortic valve disease, and destruction of the aortic
root. In our retrospective study, four patients (7%; 4/55)
were found to have such pathologies including three Marfan
patients. Thus, only one non-Marfan patient required valve
replacement.

The valve conservation rate could be attributed to the
method of repair, even in non-Marfan patients. Some [3,6]
advocate the more frequent performance of root replace-
ment in patients with acute dissection in order to obliterate
the diseased aortic wall, whereas others [5] argue that the
native aortic valve can be preserved in most patients by
classical repair using GRF glue by simple reconstruction
of the aortic root and the STJ because acute AR in patients
with a non-dilated aortic root is due to displacement of the
valve commissures and prolapse of the leaflets. Recently,
intraoperative transesophageal echocardiography has been
used to examine the mechanism of AR and the implications
for aortic valve repair [12,13], and some authors [14] have
suggested that the size of the aortic valve annulus is an
independent risk factor for aortic root reoperation. In our
experience, the aortic valve could be preserved in most
instances, regardless of preoperative AR. This is particu-
larly true of non-Marfan patients. No reoperation for the
aortic valve has been necessary for operative survivors
whose aortic valve was preserved so far.

The other issue to be addressed in repair of the proximal
aorta is the method of repair, because debate continues as to
whether glue repair is superior to classic resuspension using
layers of Teflon felt. Bachet et al. [15] reported that the
readaptation of the dissected aortic wall layers by use of
GRF glue is helpful in providing stability of the vessel
wall and hemostasis of the subsequent anastomosis with a
vascular graft. This was confirmed by others [5,16], show-
ing that the aortic valve can be preserved in most patients
and glue is durable, whereas some [17,18] suggested
complications associated with the GRF glue, possibly due
to the toxic effects of the formalin component. In 1995, we
started to use GRF glue for reinforcement of the dissected
aorta in acute type A aortic dissection, but Teflon felt is used
outside the aorta. We confirmed that GRF glue has the
advantages of simplicity and enhancing the suture-holding
capacity, resulting in a shorter duration of perfusion.
However, classical repair could also provide sufficient
results in preserving the aortic valve and its durability,
and the classical repair was even better than GRF repair,
although the number of patients was not sufficient to dem-
strate a significant difference between these two methods.
Care should be taken that the amount of formalin adminis-
tered to the glue components remains as low as possible [17]
and further studies are required to elucidate whether GRF
repair is superior to classic resuspension using layers of
Teflon felt.

4.2. Valve preservation in chronic type A aortic dissection

As discussed above, there are many reports regarding
aortic valve preservation in acute type A aortic dissection.
However, few reports [1,10] are available on management
of AR in chronic type A aortic dissection during the last
decade. In this study, although the incidence of significant
AR was similar for both acute and chronic type A aortic
dissections (Table 3), severe AR was noted in chronic
dissection compared with acute dissection. In addition, the
incidence of AR grade II or greater in those who were found
to have a dissection below the STJ was more frequent in
chronic dissection (80%) than in acute dissection (48%;
P = 0.043). This is probably because the STJ and/or the
aortic annulus were more enlarged and the aortic valve leaf-
lets were elongated due to long-standing AR in chronic
dissection. Therefore, the surgical strategy for AR due to
chronic type A aortic dissection may be different from that
for acute type A aortic dissection. In our experience with
chronic dissection, the aortic valve was preserved with clas-
sical techniques in all patients with AR grade II, whereas the
aortic root was replaced in eight of 11 patients with AR
grade III or greater. Although the preoperative sizes of the
annulus and STJ were not available for all patients, dissec-
tions extended below the STJ and the STJ and/or annulus
were enlarged in patients with AR grade III. Therefore, we
believe, in contrast to acute dissection where the aortic
valve can be preserved in most cases regardless of the AR
grade, either a composite valve-graft or a separate valve and
an aortic graft replacement need to be considered in chronic
type A aortic dissection with AR greater than grade III.

Recently, aortic valve-sparing procedures, remodeling
[19], and reimplantation [20] have been advocated in the
repair of type A aortic dissection in order to remove all of
the dissected aortic wall together with the preservation of
the aortic valve, although we did not employ them in any
case presented herein. These procedures are promising for
acute type A aortic dissection [21,22], and aortic valve-
sparing procedures, possibly requiring annuloplasty and
adjustment of leaflet length [23], and may be promising
for those patients with chronic dissection having hemody-
namically significant AR.

4.3. Conclusion

This retrospective study suggests that preservation of the
aortic valve in acute type A aortic dissection is feasible in
non-Marfan patients regardless of the degree of AR,
whereas in chronic type A aortic dissection, aortic valve
replacement needs to be considered when the degree of
AR is greater than moderate because of the enlarged STJ
and/or annulus and the elongated leaflet length. Aortic
valve-sparing procedures, including annuloplasty and
adjustment of leaflet length, may be promising procedures
for those patients. The freedom from postoperative AR
grade III or greater indicated satisfactory mid- to long-
term results with a low incidence of reoperation in those whose aortic valve was preserved in both acute and chronic type A aortic dissections.

References


