Signature: Med Sci Monit, 2002; 8(3): CR165-168
PMID: 11887029

Received: 2002.01.08
Accepted: 2002.01.24
Published: 2002.03.11

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

When is total aortic arch replacement indicated in patients with acute aortic dissection?

Paul P. Urbanski [redacted]

Clinic of Cardiosurgery, Bad Neustadt, Germany

Summary

Background: The purpose of this preliminary study was to evaluate the effectiveness of our surgical strategy for acute aortic dissection with special emphasis on curative resection of the dissected segments of the aorta.

Material/Methods: Between January 1995 and April 1999, 29 patients underwent surgery for acute aortic dissection. In 16 patients (Group 1) the dissection was limited to the ascending aorta (8 patients – Group 1a) or involved the ascending aorta and the entire aortic arch (8 patients – Group 1b). Complete resection of all dissected aortic segments (ascending aorta or ascending aorta with complete aortic arch) was performed in these cases, extending to the healthy tissue border. 13 patients (Group 2) presented with dissection of the entire aorta). These patients underwent replacement of the proximal part only of the dissected aorta.

Results: Early mortality (within 30 days) and the incidence of perioperative cerebrovascular events was 3.4% and 10.3% respectively. These events all occurred in Group 2. During the follow-up period of up to six years, there were no significant differences between the surviving patients in regards to long-term mortality and morbidity, although a persisting patent false lumen was observed in seven patients from Group 2.

Conclusions: Extension of ascending aorta replacement to include the complete aortic arch can be accomplished in patients amenable to complete resection of the dissected aorta without increasing operative risk and with good mid-term results. We believe that total aortic arch replacement is indicated in these cases.

key words: **acute aortic dissection • aortic arch • subtypes of aortic dissection**

Full-text PDF: http://www.MedSciMonit.com/pub/vol_8/no_3/2407.pdf
File size: 76 kB
Word count: 1747
Tables: 4
Figures: –
References: 10

Author's address: Dr. Paul P. Urbanski, Herz- und Gefaess-Klinik, Salzburger Leite 1, 97616 Bad Neustadt, Germany, e-mail: urbanski@kardiochirurg.de

BACKGROUND

Attitudes towards replacement of the aortic arch in acute type A aortic dissection vary greatly, ranging from the conservative approach, which is to perform the procedure only in exceptional cases because of the potentially higher surgical risk of arch replacement, to the aggressive approach, which advocates arch replacement regardless of the site of entry [1–6].

Here we report early and midterm outcomes after surgical repair of acute aortic dissection, with particular emphasis on complete resection of the dissected aortic arch.

MATERIAL AND METHODS

Between January 1995 and April 1999, 29 patients were operated on by the author to repair acute aortic dissection.

The diagnosis of aortic dissection and valvular function was determined in all patients by transesophageal echocardiography. Computer tomography was additionally performed in 26 patients. Angiography was only conducted in stable patients known or suggested to have coronary artery heart disease (15 patients). The extent of aortic resection always depended on the localization of the entry and extent of the dissection. If technically feasible, a complete resection of all dissected aortic segments was performed. Curative resection of the dissected aorta was judged possible on the basis of imaging results, and this evaluation was confirmed intraoperatively in 16 patients (Group 1). Dissection extended from the ascending aorta to the base of the innominate artery in eight patients (Group 1a), and involved the entire aortic arch to the proximal descending aorta in another eight patients (Group 1b). The entire aorta, in some cases including the supraaortic branches (nine patients) and/or pelvic arteries (eight patients) was dissected in the remaining 13 patients (Group 2).

Preoperative patient data are presented in Table 1.

Surgical technique

A median sternotomy was performed in all patients. Cardiopulmonary bypass was established by cannulation of the common femoral artery and the right atrium. The aorta was not cross-clamped in any patient, but opened in deep hypothermic circulatory arrest, inspected and resected. In addition to hypothermic circulatory arrest, brain protection was achieved by pharmacological means (thiopental, cortison) and by packing the head in ice. We did not use retrograde or selective antegrade cerebral perfusion. The extent of the aortic resection was adjusted according to the criteria mentioned above. Curative resection of the dissected aortic segments was possible in 16 patients (Group 1). In eight patients (Group 1a), the ascending aorta was transected obliquely from the base of the innominate artery to the concave curvature of the arch and the distal aortic segment was anastomosed to the end of a collagen-coated Dacron graft. We prefer to call this technique 'distal open anastomosis' involving the aortic arch, and deliberately avoid using the term 'hemiarch repair' (see Comment). The dissected aortic arch was resected completely in another eight patients (Group 1b) and the tube graft was anastomosed to the proximal descending aorta. As the supraaortic branches were not involved in the dissection, it was possible in all cases to excise them from the aortic arch and reimplant them into the tube graft jointly as one narrow patch. The graft was then cross-clamped proximal to the innominate artery in all 16 patients, and extracorporeal circulation was continued by retrograde femoral artery perfusion.

Curative resection of the dissected segments was not possible in another 13 patients (Group 2) because of the extent of dissection into the distal aorta. After the aorta was opened in deep hypothermic circulatory arrest, single intimal tears in the ascending aorta were observed in eight cases, and multiple tears in the ascending aorta and aortic arch were present in two cases. In three cases, no tear was found in the ascending aorta or in the aortic arch, thus confirming the preoperative diagnosis of a retrograde dissection. In 11 cases, the ascending aorta was transected obliquely from the base of the innominate artery to the concave curvature of the arch, removing as much of the dissected aortic wall as possible. The dissected layers of the aorta were reapproximated with gelatin-resorcine-formaldehyde glue (Colle Chirurgicale Cardial, Cardial-Bard, St.-Etienne, France) or more recently with synthetic glue (Glubran 2, GEM S.r.l., Viareggio (LU), Italy) and anastomosed to a Dacron graft. The suture line was reinforced by attaching a Teflon strip to the outside of the aortic wall. In

Table 1. Preoperative patient characteristics*.

Variables+	Group 1 curative aortic replacement			Group 2 non curative aortic replacement
	Group 1 a ascending	Group 1 b ascending + arch	Total	
No. of patients	8	8	16	13
Age	63.5 (9.8)	54.5 (12.0)	59.0 (11.8)	61.1 (11.3)
Male/female	7/1	4/4	11/5	7/6
Emergency/ urgent procedure	8	6	14	10
Previous surgery	3	1	4	2
•CABG	3	0	3	0
•AVR	0	1	1	2
Concomitant disease				
•Diabetes	2	0	2	1
•Previous neurological events	1	1	2	1
•Hypertension	2	3	5	6
•CHD	3	2	5	4

* - No significant differences between Groups 1 and 2 or Subgroups 1a and 1b (Student's t–test for unpaired samples and Fischer's exact test);
+ - Data are expressed as number of occurrences or as mean standard deviation; CABC – coronary artery bypass grafting; AVR – aortic valve replacement; CHD – coronary heart disease

one case the aortic arch was totally replaced. The supraaortic branches were reimplanted separately into the graft because of intimal tears between the vascular origins. In another case, partial arch replacement was performed with the inclusion of the innominate artery. The dissected innominate artery was resected proximally and reimplanted into the tube graft using a graft interposition. In the last two cases, also, the dissected layers of the distal aorta were approximated with glue prior to anastomosis.

As it is difficult to determine during surgery whether there are other intimal tears in the descending aorta, only antegrade extracorporeal circulation was continued in these cases until recannulation to the tube graft was completed. We used a tube graft with a side branch (InterGard-Hemabridge, InterVascular, La Ciotat, France) to establish arterial access.

The remaining procedure was identical in all patients (Group 1 and Group 2). Depending upon the extent of dissection either a supracoronary graft or an infracoronary aortic valved composite graft replaced the proximal ascending aorta. A final anastomosis connecting the two grafts was then completed. The operative data are provided in Table 2.

RESULTS

Early mortality and morbidity

There was one perioperative death (3.4%) in the entire study population. One patient from Group 2 died on the 15th postoperative day following a perioperative myocardial infarction. His underlying coronary artery disease could not be diagnosed by preoperative angiography because of cardiac instability, and the diagnosis was not established until autopsy.

Three perioperative cerebrovascular events were also observed in Group 2. In all these patients diffuse dissection involving the supraaortic and/or pelvic arteries was present. There were no cerebrovascular complications in Group 1, though recurrent left paresis occurred in two patients after complete aortic arch replacement. Two patients in Group 1a who had had previous cardiac surgery required rethoracotomy because of bleeding. Early mortality and morbidity data are presented in Table 3.

Patient survival and late morbidity

Follow-up was complete for all patients. The length of follow-up was similar for both groups. The mean duration of follow-up was 33±13 months (range 16 to 66) for Group 1 and 30±16 months (range 15 to 58) for Group 2 (p=ns).

There were two deaths and no reoperations for the duration of follow-up. One patient died suddenly following a cardiac arrest. On autopsy non-specific findings following ascending aorta and arch replacement were documented. The second patient died because of pneumonia subsequent to perioperative cerebral damage. A patent false lumen in the distal descending aorta with no signs of progression was present in seven patients in Group 2. In three patients a primary intimal tear was localized in the descending aorta; in the remaining four patients, the intimal tear was seen in the proximal aorta.

Only one thromboembolic event (minor stroke in a Group 1a patient without a valved conduit but with chronic atrial fibrillation) and no hemorrhagic complications were reported.

DISCUSSION

Surgical therapy for acute aortic dissection with involvement of the ascending aorta is a recognized procedure.

Table 2. Operative data.

Variables*	Group 1 curative aortic replacement			Group 2 non curative aortic replacement
	Group 1 a ascending	Group 1 b ascending + arch	Total	
CPB duration (min)+	185 (69)	196 (31)	90 (52)	196 (51)
Aortic cross-clamp time (min)	80 (27)	90 (25)	85 (20)	79 (19)
Circulatory arrest duration (min)	15 (10)	37 (9)	26 (15)	32 (22)
Lowest rectal temperature (°C)	22.0 (3.7)	21.1 (1.6)	21.6 (2.8)	22.2 (1.7)
Concomitant CABG	1	1	2	4
Composite valve graft	3	2	5	5
Aortic valve replacement	1	1	2	0

* – Data are expressed as number of procedures or as mean standard deviation; + – Including period of circulatory arrest; CPB – Cardiopulmonary bypass; CABG – coronary artery bypass grafting

Table 3. Early mortality and morbidity.

Variables	Group 1 curative aortic replacement			Group 2 non curative aortic replacement
	Group 1 a ascending	Group 1 b ascending + arch	Total	
Death	0	0	0	1
Reoperation for bleeding	2	0	2	0
Myocardial infarction	0	0	0	1
Permanent neurological defect	0	0	0	3
Recurrent nerv paresis	0	2	2	0
Respiratory failure	2	0	2	1
Permanent pacemaker	1	2	3	1
Pericardial effusion	1	0	1	1

* – No significant differences between Groups 1 and 2 or subgroups 1 a and 1 b (Fischer's exact test)

However, for various reasons discussion continues as to whether aortic arch replacement should be performed when dissection extending into and past the aortic arch is present. Published studies have reported on small patient populations resulting in low statistical power and questionable statistical relevance. These operations were performed over many years, which may not take into account advances in medicine and improved surgical techniques. The patient populations so far described are not homogenous due to variations in entry sites, extent of dissection, and the percentage of patients with chronic dissection, thus limiting the comparability and reproducibility of the results.

Finally, there are significant discrepancies in the number of patients presenting with so-called hemiarch replacements. We find this term difficult to define and prefer the description of an open distal anastomosis using the aortic arch. We further distinguish between partial arch replacement, with the replacement of a least one supraaortic branch, and total aortic arch replacement.

In this preliminary study the patient groups are small, but all surgical procedures were performed by the same surgeon over a relatively short period (4 years) using the same surgical criteria. These criteria have been arranged into a classification of aortic dissection according to the extent of dissection and entry site. Precise classification of dissection types in this manner allows a mostly similar therapeutic strategy or surgical method to be matched to the individual subgroups [7,8]. This in turn can make the patient populations, methods and results of various studies comparable and reproducible (Appendix 1). This aspect is particularly important, since randomized studies evaluating aortic arch replacement in the presence of acute aortic dissection are currently not available, and are unlikely to be conducted in the future.

Our experience suggests that in patients in whom a complete resection of the dissected aorta is possible, the extension of the aortic replacement into the aortic arch does not increase surgical risk. The duration of circulatory arrest for total aortic arch replacement in which the anastomoses are made to non-dissecting vessels walls is no longer than that for ascending aorta replacement with one complicated anastomosis using the dissected aortic arch. We also observed a low incidence of bleeding using this technique, compared to the reports of other authors [9], and no additional survival-limiting aortic events were reported, such as patent false lumens [10]. On the other hand, we believe that a complete aortic arch replacement is not beneficial when a complete resection of the dissected aortic wall cannot be attained. In such cases we are in agreement with other authors [1–3,5,7–10], that a complete or partial arch replacement is indicated only when a primary intimal tear is located in the arch or when the arch is aneurysmatically dilated.

Appendix 1. Diagnosis, methods and results.

Subtypes of acute aortic dissection according to extent of dissection (D), entry site (E) and repair (R)	No. of Patients	Early mortality	Late mortality	Persisting patent false lumen in survivors
Curative aortic replacement	16	0	0	0
D-a; E-a; R-a	8	0	0	0
D-ab; E-a; R-ab	8	0	0	0
Non curative aortic replacement	13	1	2	7
D-abc; E-a; R-a	8	1	1	3
D-abc; E-ab; R-ab	2*	0	1	1
D-abc; E-c; R-a	3	0	0	3

* – in on case partial arch replacment was perfomed; a – ascending aorta; b – aortic arch; c – descending aorta

CONCLUSIONS

The clinical results of this preliminary study show that the extension of ascending aorta replacement to include the complete aortic arch can be accomplished in patients amenable to complete resection of the dissected aorta without increasing operative risk and with good mid-term results. We believe that total aortic arch replacement is indicated in this specific patient population.

Further investigation with larger study populations is needed to confirm that the clinical outcome of aortic arch replacements can be improved by the complete resection of all dissected aortic wall segments.

Acknowledgements

I would like to thank Oliver Rossol for statistical assessment, Silvia Martin for manuscript preparation, and Monica Meyer for reviewing the manuscript.

REFERENCES:

1. Yun KL, Glower DD, Miller DC et al: Aortic dissection resulting from tear of transverse arch: Is concomitant arch repair warranted? J Thorac Cardiovasc Surg, 1991; 102: 355-70
2. Heinemann M, Laas J, Jurmann M et al: Surgery extended into the aortic arch in acute Type A dissection. Indications, techniques and results. Circulation, 1991; 84 [Suppl III]: III-25-III-30
3. Crawford ES, Kirklin JW, Naftel DC et al: Surgery for acute dissection of ascending aorta. Should the arch be included? J Thorac Cardiovasc Surg, 1992; 104: 46-59
4. Kazui T, Kimura N, Yamada O, Komatsu S et al: Total arch graft replacement in patients with acute type A aortic dissection. Ann Thorac Surg, 1994; 58: 1462-8
5. Sabik JF, Lytle BW, Blackstone EH et al: Long-term effectiveness of operations for ascending aortic dissections. J Thorac Cardiovasc Surg, 2000; 119: 946-62
6. Hirotani T, Kameda T, Kumamoto T, Shirota S: Results of a total aortic arch replacement for an acute aortic arch dissection. J Thorac Cardiovasc Surg, 2000; 120: 686-91
7. Lansman SL, McCullough JN, Nguyen KH et al: Subtypes of acute aortic dissection. Ann Thorac Surg, 1999; 67: 1975-8
8. Guilmet D, Bachet J, Goudot B et al: Aortic dissection: Anatomic types and surgical approaches. J Cardiovasc Surg, 1993; 34: 23-32
9. Massimo CG, Presenti LF, Favi PP et al: Excision of the aortic wall in the surgical treatment of acute type A aortic dissection. Ann Thorac Surg, 1990; 50: 274-6
10. Ergin MA, Phillips RA, Galla JD et al: Significance of distal false lumen after Type A dissection repair. Ann Thorac Surg, 1994; 57: 820-5

Index Copernicus

Global Scientific Information Systems for Scientists by Scientists

TM
INDEX COPERNICUS INTERNATIONAL

www.IndexCopernicus.com

- EVALUATION & BENCHMARKING
- PROFILED INFORMATION
- NETWORKING & COOPERATION
- VIRTUAL RESEARCH GROUPS
- GRANTS
- PATENTS
- CLINICAL TRIALS
- JOBS
- STRATEGIC & FINANCIAL DECISIONS

Index Copernicus integrates

IC Scientists

Effective search tool for collaborators worldwide. Provides easy global networking for scientists. C.V.'s and dossiers on selected scientists available. Increase your professional visibility.

IC Virtual Research Groups [VRC]

Web-based complete research environment which enables researchers to work on one project from distant locations. VRG provides:

- customizable and individually self-tailored electronic research protocols and data capture tools,
- statistical analysis and report creation tools,
- profiled information on literature, publications, grants and patents related to the research project,
- administration tools.

IC Journal Master List

Scientific literature database, including abstracts, full text, and journal ranking. Instructions for authors available from selected journals.

IC Patents

Provides information on patent registration process, patent offices and other legal issues. Provides links to companies that may want to license or purchase a patent.

IC Grant Awareness

Need grant assistance? Step-by-step information on how to apply for a grant. Provides a list of grant institutions and their requirements.

IC Conferences

Effective search tool for worldwide medical conferences and local meetings.

IC Lab & Clinical Trial Register

Provides list of on-going laboratory or clinical trials, including research summaries and calls for co-investigators.