Early and late outcomes of repaired acute DeBakey type I aortic dissection after graft replacement

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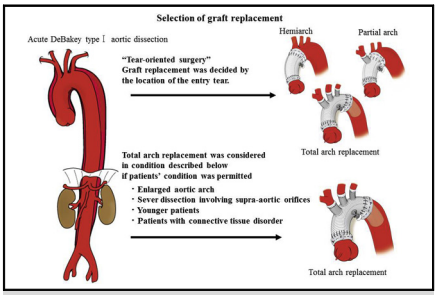
ABSTRACT

Objective: The present study aimed to determine the impact of the extent of graft replacement on early and late outcomes in acute DeBakey type I aortic dissection.

Methods: Between October 1999 and July 2014, 197 consecutive patients were surgically treated for acute DeBakey type I aortic dissection. The extent of graft replacement (hemiarch, partial, or total arch replacement) was mainly determined by the location of the primary entry. Early and late results were compared in patients after total arch replacement (n = 88) and combined hemiarch and partial arch replacement: non–total arch replacement (n = 109).

Results: The in-hospital mortality rates of the total arch replacement and non–total arch replacement groups were 10.2% and 14.7%, respectively ($P = .47$). Multivariate analysis revealed preoperative cardiopulmonary resuscitation and visceral organ malperfusion as significant risk factors for in-hospital mortality, but not total arch replacement. During a mean follow-up period of 60 ± 48 months, the 5-year survivals in the total arch replacement and non–total arch replacement groups were 88.6% ± 4.2% and 83.8% ± 4.4%, respectively ($P = .54$). Rates of distal aortic events (defined as freedom from surgery for distal aorta dilation or distal arch diameter expanding to 50 mm) at 5 years were significantly better in the total arch replacement group than in the non–total arch replacement group (94.9% ± 3.5% vs 83.6% ± 4.9%, $P = .01$).

Conclusions: The operative mortality of patients with acute DeBakey type I aortic dissection treated by total arch replacement was acceptable with good long-term survival after both total arch replacement and non–total arch replacement. The frequency of distal aortic events might be reduced in patients after total arch replacement compared with non–total arch replacement. (J Thorac Cardiovasc Surg 2016;151:341-8)



Decision making for type of graft replacement in acute DeBakey type I aortic dissection.

Central Message

Late distal aortic events might be reduced by TAR in the repair of ADIAD.

Perspective

This study shows that TAR could be performed with acceptable operative mortality in patients with acute DeBakey type I aortic dissection and could reduce late distal aortic events compared with non-TAR. Aggressive TAR could be a reasonable surgical option for patients considered high risk for distal aortic dilation.

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Acute type A aortic dissection is one of the most life-threatening cardiovascular events because it requires immediate surgical repair. Although the surgical outcomes of acute type A aortic dissection historically have been low, they have steadily improved with advances in preoperative diagnosis, surgical technique, and postoperative management.[1] However, increases in the numbers of patients who survive over the long term after initial aortic surgery have uncovered several late problems.[2-5] The aorta downstream of a replaced graft sometimes becomes dilated, and thus subsequent aortic surgery is necessary. Residual aortic dissection carries the risk of progressive aortic dilation, rupture, or secondary aortic surgery.[6,7] The likelihood of such adverse aortic events

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Abbreviations and Acronyms

ADIAD = acute DeBakey type I aortic dissection
CI = confidence interval
CNS = central nervous system
CT = computed tomography
GRF = gelatin-resorcin-formalin
HR = hazard ratio
TAR = total arch replacement

arising during follow-up after surgical treatment of acute DeBakey type I aortic dissection (ADIAD) is considered to be high because of the wide presence of a false lumen. Although hemiarch replacement is the standard surgical approach to ADIAD, this limited graft replacement cannot excise an entry tear that is located in or beyond the aortic arch. Several studies have found that the lack of an excised entry tear and a patent distal false lumen are risk factors for distal aorta expansion.[8-10] "Tear-oriented surgery" has been widely recommended, and thus total arch replacement (TAR) is sometimes required during the surgical repair of ADIAD. However, extensive graft replacement with TAR is more invasive and carries an increased potential risk of morbidity and mortality. Striking a balance among lifesaving, surgical invasiveness, and optimal long-term outcomes can be challenging when treating this lethal aortic disease. Whether or not long-term aortic events can be more effectively treated by extensive aortic replacement than by limited graft replacement remains controversial. We investigated the early and late impact of extent of surgical graft replacement in patients with ADIAD.

MATERIAL AND METHODS

Between October 1999 and July 2014, 197 consecutive patients with ADIAD underwent aortic replacement at Kobe University Graduate School of Medicine. The extent of graft replacement was based on a tear-oriented strategy and several clinical factors (Figure 1). Patients with aortic arch dilation, patients with severe dissection involving supra-aortic orifices, patients who were younger, and patients with connective tissue disorders with suitable status were treated by aggressive TAR. TAR involved the entire aortic arch, with the arch branch vessels being reimplanted with individual tetra-furcated grafts. TAR was always combined with the elephant trunk technique. Hemiarch replacement included the lesser curvature of the aortic arch beyond the level of the innominate artery but did not involve the aortic arch. Partial arch replacement required reconstruction of only the innominate artery or both the innominate and left cervical arteries. Early and late results were compared between patients who received TAR (n = 88) and patients who received non-TAR, comprising partial arch (n = 12) and hemiarch (n = 97) replacement (non-TAR; n = 109). We obtained informed consent from all patients. The study protocol was reviewed and approved by the institutional database and office records, and the study complied with the Declaration of Helsinki. Patients with connective tissue disorders (7 with Marfan syndrome, 1 with Rendu-Osler-Weber disease) were excluded from this study because the aortic pathology of these patients was different from that of the normal population with ADIAD. During this study period, we repaired ADIAD in 8 patients with connective tissue disorders using hemiarch replacement with an aortic valve–sparing operation (n = 1), TAR (n = 2), and TAR with aortic valve–sparing operation (n = 5). One patient had hemiarch replacement because of preoperative severe hemodynamic shock, and he was not preoperatively diagnosed with Marfan syndrome. No hospital or late deaths occurred in these patients. Five of them underwent a second operation comprising TAR (n = 1), descending aorta replacement (n = 2), and thoracoabdominal aortic repair (n = 2) for distal aorta dilation or rupture. In addition to these patients, we also excluded those with iatrogenic aortic dissection and those requiring left thoracotomy.

Definition of Clinical Presentation

Cardiogenic shock was defined as preoperative systolic blood pressure less than 90 mm Hg, cardiac index less than 2.0 L/min/m^2, or a need for intravenous inotropic agents. Malperfusion syndromes were defined as signs or symptoms due to disrupted blood flow to end-organ systems classified as the central nervous system (CNS) and as coronary, visceral, or extremities. CNS disorders caused by malperfusion syndrome were classified as transient or persistent according to the duration of the clinical presentation. The description, 2 territories, refers to malperfusion in 2 organs. Postoperative neurologic dysfunction was considered permanent if it persisted at discharge and was a result of the intraoperative procedure. Transient dysfunction was defined as a temporary loss of orientation, slurred speech, agitation, or poor responses to commands. Neurologic dysfunction caused by preoperative brain malperfusion, deep shock status, and postoperative atrial fibrillation was excluded from this category.

Surgical Procedures

The principal aim of our surgical strategy for treating ADIAD is to excise the primary entry tear. In addition, if patients were considered capable of enduring extensive aortic surgery, TAR with the elephant trunk technique proceeded as described next. We found aortic arch dilation or massive arch dissection regardless of the location of the primary entry tear.

Blood pressure was monitored via bilateral radial lines and 1 femoral arterial line. Brain oxygenation was monitored using near-infrared spectroscopy. Temperature was monitored using tympanic and rectal probes. Arterial cannulation sites were determined according to the patient's status, preoperative organ malperfusion, and the preference of the surgeon, but the femoral artery was the most frequent choice. Cannulation of the ascending aorta using a guidewire has become the first choice if possible because such inflow enables the establishment of antegrade arterial inflow. A venous cannula was inserted into the right atrium, and then a cardiopulmonary bypass was established and systemic cooling was initiated. The left ventricle was vented through the right superior pulmonary vein. During the start of cardiopulmonary bypass, circulation was monitored by arterial pressure, transesophageal echocardiography, and near-infrared spectroscopy parameters. If 1 arterial cannulation site was insufficient for optimal circulation, another was added. If crossclamping was impossible during cooling, distal aortic repair was followed by aortic repair. If the clamp site was free of thrombosis, a crossclamp was placed at the distal ascending aorta. The proximal aorta was repaired first if crossclamping revealed that the circulation as normal.

Proximal Aortic Repair

The aorta was transected 1 cm distal to the sinotubular junction. Proximal reapproximation proceeded using Teflon felt outside and surgical adjuncts such as gelatin-resorcin-formalin (GRF) glue or BioGlue Nippon BXI Inc, Tokyo, Japan inside the false lumen with a