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Outcomes of circulatory arrest procedures for the treatment of thoracic aortic disease at a veterans facility

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Outcomes

Abstract

BACKGROUND: The outcomes of thoracic aortic surgery involving hypothermic circulatory arrest at a US Department of Veterans Affairs medical center were evaluated.

METHODS: Using the Veterans Affairs Continuous Improvement in Cardiac Surgery Program, all thoracic aortic operations performed with hypothermic circulatory arrest between December 1999 and December 2009 were identified (n = 24). Operative mortality and morbidity were evaluated, and survival was assessed by using the Kaplan-Meier method.

RESULTS: Aortic dissection was the underlying disease in 10 patients (42%). Full or hemiarch aortic repair was performed in 16 patients (67%); of these operations, 3 (13%) involved elephant trunk repair. There was 1 operative death (4%). Four patients (17%) had strokes (all but 1 fully recovered), and 1 (4%) had renal failure. The survival rate was 90% at 1 year and 67% at 3 years.

CONCLUSIONS: Despite the magnitude and risk of thoracic aortic surgery involving hypothermic circulatory arrest, good outcomes can be achieved when such surgery is performed at an experienced Veterans Affairs center.

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Recent advances in surgical technique, cerebral protection strategies, and patient care have made it possible to safely perform complex aortic surgery involving hypothermic circulatory arrest (HCA) in most patients.[1–6] Nonetheless, inherent in thoracic aortic surgery is the propensity for cerebral damage and atheroembolism and, consequently, a considerable risk for morbidity and mortality; therefore, such cases are often performed at specialized referral centers. In addition, recent studies have shown that thoracic aortic surgery produces superior outcomes when performed at experienced, high-volume aortic surgical centers.[7–10]

Our objective was to evaluate contemporary outcomes of open thoracic aortic surgery involving HCA at a US Department of Veterans Affairs (VA) medical center affiliated with a major academic aortic program.

Methods

Study site

The Michael E. DeBakey VA Medical Center (MEDVAMC) is academically affiliated with Baylor College of Medicine and serves as one of its primary teaching hospitals. The MEDVAMC is an integral component of the Texas Heart

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Institute and Baylor College of Medicine cardiothoracic residency training program. The faculty members who perform thoracic aortic procedures practice primarily at the MEDVAMC, and all have been trained by the senior author (J.S.C.).

After obtaining institutional review board approval and waiver of informed consent, we used the Houston component of the VA Continuous Improvement in Cardiac Surgery Program (CICSP)[11,12] and our departmental database to identify all patients who underwent open thoracic aortic procedures at the MEDVAMC between December 1999 and December 2009 (n = 122, out of a total of 2,175 cardiovascular surgical patients). Patient charts were reviewed for verification purposes and to extract supplemental data, including procedural details. All open thoracic aortic procedures that involved HCA were included (n = 24); all endovascular procedures were excluded. For all patients, follow-up (mean, 2.0 ± 1.9 years) data were available through January 2010 or patients' deaths. Survival information was obtained from the Social Security Death Index and the CICSP.

Surgical technique

All operations were performed via a standard median sternotomy. In planned HCA cases, we prefer to perform right axillary artery perfusion via an 8-mm tube graft anastomosed end to side to the artery. This approach is coupled with dissection and isolation of the brachiocephalic artery and, in some cases, the left carotid artery. Occluding those arteries while perfusing through the right axillary artery at 10 mL/kg/min during arch surgery allows for antegrade cerebral perfusion while circulation to the rest of the body is halted. Retrograde cerebral perfusion was used in the earlier part of the series but is no longer used in our practice. We typically induce deep systemic hypothermia, cooling the patient to a nasopharyngeal temperature of 18°C, although we have recently used warmer temperatures in conjunction with antegrade cerebral perfusion when the anticipated arrest time was short. We routinely insert a left ventricular sump via the right superior pulmonary vein and administer antegrade and retrograde cold-blood potassium cardioplegia for myocardial protection. When total-body circulation is resumed, we start rewarming to a target core temperature of 36.5°C.

Outcomes

Three outcome variables were evaluated separately: perioperative morbidity, 30-day operative mortality, and midterm survival. Perioperative morbidity was defined as the presence of one or more of the following major complications: endocarditis, renal failure necessitating dialysis, mediastinitis, reoperation for bleeding, prolonged ventilation (≥48 hours), paraplegia, stroke, coma lasting >24 hours, and any complication necessitating repeat cardiopulmonary bypass or mechanical circulatory support. For operative mortality rate, we used the CICSP definition: the number of deaths that occur during the index hospitalization or within 30 days after surgery, plus any deaths that occur >30 days after surgery that are the direct result of a perioperative surgical complication. Midterm survival was defined as freedom from death from any cause at 1 and 3 years after surgery.

Risk model used to predict mortality rates

The VA CICSP prospectively collects risk-factor and outcomes data on all patients who undergo cardiac surgery at any of 44 VA cardiac surgery centers.[11,12] The CICSP reports risk-adjusted outcomes semiannually to contributing centers. Each patient's mortality risk is estimated by using the CICSP risk model, which is based on national VA data collected during the 3 years that immediately precede the release of each semiannual report.

Statistical analyses

All data were analyzed with SAS version 9.1 (SAS Institute Inc, Cary, NC). Continuous variables are reported as mean ± SD. Estimates of overall survival at 1 and 3 years were calculated by the Kaplan-Meier method and are expressed as percentages and 95% confidence intervals.

Results

Study population and aortic disease

All patients were male. Their mean age was 58.0 ± 9.2 years (range, 40–77 years). The risk profile of the patients is summarized in Table 1. Aortic dissection was the underlying disease in 10 patients (42%); 5 dissections (21%) were acute. Other indications for surgery are listed in Table 2.

Operative characteristics

Full or hemiarch aortic repair was performed in 16 patients (67%). Three patients (13%) had first-stage elephant trunk repair. The mean HCA time was 25 ± 10 minutes, and axillary cannulation with antegrade cerebral perfusion was performed in 19 patients (79%). Concomitant procedures are summarized in Table 2.

Outcomes

Whereas CICSP scores predicted a mortality rate of 13%, the observed mortality rate was 4%. Ten patients (42%) had major postoperative morbidity (Table 3). All patients received intraoperative blood transfusions: 8.0 ± 4.3 U packed red blood cells, 6.6 ± 3.9 U fresh frozen plasma,