

Avoiding aortic clamping during coronary artery bypass grafting reduces postoperative stroke

Emmanuel Moss, MDCM, MSc,^a John D. Puskas, MD,^b Vinod H. Thourani, MD,^a Patrick Kilgo, MS,^c Edward P. Chen, MD,^a Bradley G. Leshnower, MD,^a Omar M. Lattouf, MD,^a Robert A. Guyton, MD,^a Kathryn E. Glas, MD,^d and Michael E. Halkos, MD, MSc^a

Objective: The purpose of this study was to determine whether the incidence of postoperative stroke could be reduced by eliminating aortic clamping during coronary artery bypass grafting.

Methods: From 2002 to 2013, 12,079 patients underwent primary, isolated coronary artery bypass grafting at a single US academic institution. Aortic manipulation was completely avoided by using in situ internal thoracic arteries for inflow in 1552 patients (12.9%) (no-touch), a clampless facilitating device for proximal anastomoses in 1548 patients (12.8%), and aortic clamping in 8979 patients (74.3%). These strategies were assessed in a logistic regression model controlling for relevant variables.

Results: The overall incidence of postoperative stroke was 1.4% (n = 165), with an unadjusted incidence of 0.6% (n = 10) in the no-touch group, 1.2% (n = 18) in the clampless facilitating device group, and 1.5% (n = 137) in the clamp group ($P < .01$ for no-touch vs clamp). The ratio of observed to expected stroke rate increased as the degree of aortic manipulation increased, from 0.48 in the no-touch group, to 0.61 in the clampless facilitating device group, and to 0.95 in the clamp group. Aortic clamping was independently associated with an increase in postoperative stroke compared with a no-touch technique (adjusted odds ratio, 2.50; $P < .01$). When separated by cardiopulmonary bypass use, both the off-pump partial clamp and the on-pump crossclamp techniques increased the risk of postoperative stroke compared with no-touch (adjusted odds ratio, 2.52, $P < .01$; and adjusted odds ratio, 4.25, $P < .001$, respectively).

Conclusions: A no-aortic touch technique has the lowest risk for postoperative stroke for patients undergoing coronary artery bypass grafting. Clamping the aorta during coronary artery bypass grafting increases the risk of postoperative stroke, regardless of the severity of aortic disease. (*J Thorac Cardiovasc Surg* 2015;149:175-80)

See related commentary on pages 180-1.

From the Division of Cardiothoracic Surgery,^a Emory University School of Medicine, Atlanta Ga; Division of Cardiothoracic Surgery,^b Mount Sinai School of Medicine, New York, NY; Rollins School of Public Health,^c Emory University, Atlanta, Ga; and Department of Anesthesiology,^d Emory University School of Medicine, Atlanta, Ga.

Supported by the National Center for Advancing Translational Sciences of the National Institutes of Health under Award Number 5K23HL105892-03. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Disclosures: Robert A. Guyton reports consulting fees from Medtronic. Bradley G. Leshnower reports lecture fees from Medtronic, St. Jude, and Cryolife. Omar M. Lattouf reports equity ownership in TCT, Inc. Vinod H. Thourani reports consulting fees for Edwards, Boston Scientific, and St. Jude. Michael E. Halkos reports consulting fees from intuitive Surgical, and consulting and lecture fees from Medtronic. The other authors have nothing to disclose with regard to commercial support.

Read at the 94th Annual Meeting of The American Association for Thoracic Surgery, Toronto, Ontario, Canada, April 26-30, 2014.

Received for publication April 28, 2014; revisions received Aug 31, 2014; accepted for publication Sept 8, 2014; available ahead of print Oct 5, 2014.

Address for reprints: Michael E. Halkos, MD, MSc, Division of Cardiothoracic Surgery, Emory University School of Medicine, 550 Peachtree St NE, 6th floor MOT, Atlanta, GA 30308 (E-mail: mhalkos@emory.edu).

0022-5223/\$36.00

Copyright © 2015 by The American Association for Thoracic Surgery

<http://dx.doi.org/10.1016/j.jtcvs.2014.09.011>

Coronary artery bypass grafting (CABG) is one of the most heavily scrutinized surgical procedures performed worldwide. Despite this, many questions regarding optimal strategies for reducing perioperative morbidity remain unanswered. Postoperative stroke (PS) is a rare but devastating complication of CABG surgery, occurring in approximately 1.5% to 3.5% of all surgeries.^{1,2} PS is the only major cardiovascular complication for which percutaneous coronary intervention has shown an advantage over CABG, so it is imperative to study PS and minimize its occurrence.³ Because manipulation of the ascending aorta has been proposed as the primary culprit leading to cerebral atheroembolism, much focus has been placed on exploring devices and operative techniques that minimize aortic manipulation.

In the United States, the majority of CABG procedures currently are performed with the use of cardiopulmonary bypass, which in almost all cases implies cannulation and clamping of the ascending aorta. Depending on the strategy for proximal anastomosis, the aorta may be clamped only once or a second time using a partial clamp. Off-pump coronary artery bypass (OPCAB) gives the surgeon more freedom to dictate the degree of aortic manipulation. Often, a partial aortic clamp is used to allow proximal anastomoses to be sewn in a bloodless field. However, aortic clamping

Abbreviations and Acronyms

AOR	= adjusted odds ratio
CABG	= coronary artery bypass grafting
CFD	= clampless facilitating device
CI	= confidence interval
OPCAB	= off-pump coronary artery bypass
PROPS	= predicted risk of postoperative stroke
PS	= postoperative stroke
STS	= Society of Thoracic Surgeons

can be avoided completely with the use of clampless facilitating devices (CFDs) or proximal anastomotic connectors. Finally, a “no touch” technique can be used in which aortic manipulation is avoided completely by providing inflow to all grafts from 1 or 2 in situ internal thoracic arteries or using a hybrid approach when clinically appropriate. The purpose of this study was to determine whether eliminating aortic clamping could reduce the incidence of PS in patients undergoing CABG surgery.

MATERIALS AND METHODS

Patients were identified by querying Emory University’s Institutional Society of Thoracic Surgeons (STS) Adult Cardiac Surgery database for all patients undergoing primary, isolated CABG between January 2002 and July 2013. Patients undergoing redo or concomitant surgeries were excluded, as well as any on-pump CABG performed without aortic clamping. Individual chart review was performed to complement information entered in the STS database. This study was approved by Emory University’s Institutional Review Board, which waived the need for individual patient consent. STS definitions were used to identify perioperative outcomes. Stroke was defined as any confirmed neurologic deficit of abrupt onset caused by a disturbance in blood supply to the brain that did not resolve within 24 hours.

Surgical Technique

All patients underwent on-pump or off-pump primary, isolated CABG. The clamping technique and use of cardiopulmonary bypass were dictated by the surgeon and the clinical scenario. For all on-pump cases, 1 or 2 (crossclamp and partial occluding clamp) aortic clamps were used. OPCAB surgeries included patients who underwent median sternotomy or minimally invasive CABG with thoracoscopic or robotic assistance via minithoracotomy. OPCAB clamping strategies for proximal anastomoses included (1) single partial clamp, (2) clampless technique with a facilitating device (Heartstring; Maquet Cardiovascular, San Jose, Calif), or (3) a “no-touch” technique without cannulation or proximal anastomosis involving the ascending aorta; these surgeries consisted of in situ single or double thoracic grafts with other conduits, when present, being anastomosed end-to-side to the thoracic pedicles.

Epi-aortic ultrasound was performed in the majority of patients in this study.⁴⁻⁶ This practice was introduced at Emory University in 2002 and has been gradually adopted to now include all patients undergoing cardiac surgery via sternotomy in whom cannulation or clamping of the ascending aorta is being considered. Aortic grading ranges from 1 to 5: 1, normal (<2 mm thickness); 2, minimal disease (2-3 mm thickness); 3, moderate disease (3-5 mm thickness); 4, severe disease (>5 mm thickness); 5, mobile plaque present in the ascending aorta.

Statistical Analysis

Groups were analyzed retrospectively according to the aortic manipulation strategy used: no touch (N = 1550), facilitating (N = 1551), off-pump partial clamp (N = 6449), and on-pump (N = 2529). Numeric and categorical variables were compared across groups using general linear modeling and chi-square testing, respectively (Tables 1 and 2).

For modeling purposes, missing data were assessed for model terms and determined to be limited to the predicted risk variables (n = 2, 0.02%) and epi-aortic grade (n = 367, 3.04%). A standard multiple imputation algorithm was used to avoid the deletion of these cases with missing data. Ten imputations were made and results were combined in such a way as to maintain the variance-covariance structure of the existing complete cases.

Multivariable logistic regression was used to model our outcomes of interest as a function of the manipulation groups. Each model was adjusted for the relevant STS Risk Score in an attempt to adjust for baseline risk; predicted risk of permanent stroke for stroke; predicted risk of mortality for death; predicted risk of morbidity and mortality for myocardial infarction, major adverse cardiac event, transfusion, and atrial fibrillation; predicted risk of reoperation for bleeding; predicted risk of prolonged ventilation for prolonged ventilation; and predicted risk of renal failure for renal failure. Each outcome model was also adjusted for year of surgery, epi-aortic grade, and use of robotic or a thoracoscopic assistance. These variables were chosen because of their known covariate status with the outcomes and because the risk scores do not account for them. All of the possible pairwise comparisons of groups were calculated, resulting in 6 comparisons. Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were calculated. All analyses were performed using SAS 9.3 (SAS Institute, Inc, Cary, NC). All tests were evaluated at the 0.05 alpha level. No adjustments were made for multiple comparisons.

RESULTS

From January 2002 to July 2013, 12,079 patients meeting the study’s inclusion and exclusion criteria underwent primary isolated CABG at our institution (Figure 1); 8978 patients (74.3%) were in the clamp group, with 6449 (53.4%) undergoing OPCAB using a partial clamp and 2529 (20.9%) undergoing on-pump CABG with 1 or 2 clamps. The CFD group consisted of 1551 patients (12.8%), and the “no-touch” group included 1550 patients (12.8%). Details of the demographics of these patient groups are listed in Table 1.

The overall incidence of PS was 1.4% (n = 165). This corresponded to 137 strokes in the clamp group (1.5%), 18 strokes in the CFD group (1.2%), and 10 strokes in the no-touch group (0.6%). On unadjusted comparison, there were significantly less strokes in the no-touch group compared with the clamp group. A summary of unadjusted comparisons is shown in Table 2. The observed to expected ratio of stroke in each group, compared with the STS predicted risk of postoperative stroke (PROPS) score, is depicted in Figure 2, and was 0.48, 0.61, and 0.95 for the no-touch, CFD, and clamp groups, respectively. Table 3 shows the ascending aortic atherosclerotic burden, as assessed by epi-aortic ultrasound, according to group.

On multiple logistic regression analysis, controlling for pump group, epi-aortic ultrasound grade, PROPS score, and operative approach, aortic clamping was independently

Download English Version:

<https://daneshyari.com/en/article/2980059>

Download Persian Version:

<https://daneshyari.com/article/2980059>

[Daneshyari.com](https://daneshyari.com)