Supplementary Appendix

This appendix has been provided by the authors to give readers additional information about their work.

Supplement to: Bonow RO, Maurer G, Lee KL, et al. Myocardial viability and survival in ischemic left ventricular dysfunction. N Engl J Med 2011;364:1617-25. DOI: 10.1056/NEJMoa1100358.

Supplementary Appendix

Myocardial Viability and Survival in Ischemic Left Ventricular Dysfunction

Robert O. Bonow, MD, Gerald Maurer, MD, Kerry L. Lee, PhD,
Thomas A. Holly, MD, Philip F. Binkley, MD, Patrice Desvigne-Nickens, MD,
Jaroslaw Drozdz, MD, PhD, Pedro S. Farsky, MD, Arthur M. Feldman, MD,
Torsten Doenst, MD, PhD, Robert E. Michler, MD, Daniel S. Berman, MD,
Jose C. Nicolau, MD, PhD, Patricia A. Pellikka, MD, Krzysztof Wrobel, MD,
Nasri Alotti, MD, PhD, Federico M. Asch, MD, Liliana E. Favaloro, MD,
Lilin She, PhD, Eric J. Velazquez, MD, Robert H. Jones, MD,
Julio A. Panza, MD

On behalf of the Surgical Treatment for Ischemic Heart Failure (STICH) Trial Investigators

From Northwestern University Feinberg School of Medicine, Chicago, IL (R.O.B.,T.A.H); Medical University of Vienna, Vienna, Austria (G.M.); Duke Clinical Research Institute, Duke University Medical Center, Durham, NC (K.L.L.,L.S.,E.J.V.,R.H.J); Ohio State University Medical Center Columbus, OH (P.F.B.); National Heart, Lung, and Blood Institute, Bethesda, MD (P.D-N.); Medical University of Lodz, Lodz, Poland (J.D.); Instituto Dante Pazzanese de Cardiologia (P.F.) and Instituto do Coração – HC/FMUSP (J.C.N.) – both in Sao Paulo, Brazil; Jefferson Medical College, Philadelphia, PA (A.M.F.); Heart Center, University of Leipzig, Leipzig, Germany (T.D.); Montefiore Medical Center/Albert Einstein College of Medicine, New York, NY (R.E.M.); Cedars Sinai Medical Center, Los Angeles, CA (D.S.B.); Division of Cardiovascular Diseases, Mayo Clinic, Rochester, MN (P.A.P); John Paul II Hospital, Krakow, Poland (K.W.); Zala County Hospital, Zalaegerszeg, Hungary (N.A.); Washington Hospital Center, Washington, DC (F.M.A.,J.A.P.); and University Hospital Favaloro Foundation, Buenos Aires, Argentina (L.E.F.)

Contents:

STICH Hypothesis 1 Investigators, Leadership, and Trial Committees

The following institutions and principal investigators (PI), lead surgeons (LS), lead cardiologists (LC),study coordinators (SC), and affiliated investigators (AI) participated in STICH Hypothesis 1 enrollment:

Investigators *(listed in descending order of the number of randomized patients): Research Institute of Circulation Pathology, Novosibirsk, Russia:* A. Cherniavsky-PI, A. Marchenko-LS, A. Romanov-SC; *Medical University of Silesia, Katowice, Poland:* S. Wos-PI, M. Deja-LS, K. Golba-LC, M. Malinowski-SC; *Dedinje Cardiovascular Institute, Belgrade, Serbia:* S. Gradinac-PI, D. Kosevic-LC, M. Vukovic-LC; L. Djokovic-SC; *Medical University of Lodz, Lodz, Poland:* M. Krzeminska-Pakula-PI, R. Jaszewski-LS, J. Drozdz-LC, L. Chrzanowski-SC; *Capital Health/Queen Elizabeth II Health Sciences Centre, Halifax, Canada:* M. Rajda-PI, I. Ali-LS, J. Howlett-LC, M. MacFarlane-SC; *SAL Hospital and Medical Institute, Ahmedabad, India:* A. Jain-PI, H. Shah-SC; *Nizams Institute of Medical Sciences, Hyderabad, India:* D. Rakshak-PI, A. Saxena-SC; *Silesian Center for Heart Diseases, Medical University of Silesia, Zabrze, Poland:* M. Zembala-PI, R. Przybylski-LS, T. Kukulski-LC, J. Wasilewski-SC; *Klinika Kardiochirurgii PUM, Szczecin, Poland:* S. Wiechowski-PI, M. Brykczynski-LS, M. Kurowski-LC, K. Mokrzycki-SC; *John Paul II Hospital, Krakow, Poland:* J. Sadowski-PI, B. Kapelak-LS, D. Sobczyk-LC, D. Plicner-SC, K. Wrobel-AI; *Instituto Dante Pazzanese de Cardiologia, Sao Paulo, Brazil:* L. Piegas-PI, P. Paulista-LS, P. Farsky-LC, C. Veiga Kantorowitz-SC; *National Institute of Cardiology, Warsaw, Poland:* Z. Sadowski-PI, Z. Juraszynski-LS, H. Szwed-LC, R. Dabrowski-SC; *Medical University of Gdansk, Gdansk, Poland:* J. Rogowski-PI, R. Pawlaczyk-LS, A. Rynkiewicz-LC, P. Betlejewski-SC; *University of Freiburg, Freiburg, Germany:* M. Siepe-PI, A. Geibel-Zehender-LC, Carole Cuerten-SC; *Ohio State University Medical Center, Columbus, USA:* R. Higgins-PI, J. Crestanello-LS, P. Binkley-LC, D. Jones-SC, B. Sun-AI; *Duke University Medical Center, Durham, USA:* E. Velazquez-PI, P. Smith-LS, C. Milano-LS, P. Adams-SC; *Shands at the University of Florida, Gainesville, USA:* J. Hill-PI, T. Beaver-LS, D. Leach-SC; *All India Institute of Medical Sciences, New Delhi, India:* B. Airan-PI, S. Das-SC; *St. Vincent's Hospital Melbourne, Melbourne, Australia:* M. Yii-PI, D. Prior-LC, J. Mack-SC; *Toronto General Hospital, Toronto, Canada:* V. Rao-PI, R. Iwanochko-LC, J. Renton-SC; *Siriraj Hospital, Bangkok, Thailand:* P. Panchavinnin-PI, N. Phuangkaew-SC; *Slaski Osrodek Kardiologii AM, Katowice, Poland:* A. Bochenek-PI, M. Krejca-LS, M. Trusz-Gluza-LC, K. Wita-SC; *Ospedali Riuniti Di Bergamo, Bergamo, Italy:* P. Ferrazzi-PI, A. Gavazzi-LC, M. Senni-SC; *GKNM Hospital, Coimbatore, India:* S. Natarajan-PI, C. Padmanabhan-LS; *Montreal Heart Institute, Montreal, Canada:* N. Racine-PI, D. Bouchard-LS, A. Ducharme-LC, H. Brown-SC; *Zala County Hospital, Zalaegerszeg, Hungary:* N. Alotti-PI, G. Lupkovics-SC; *Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, India:* S. Kumar-PI, S. Agarwal-LS, N. Sinha-LC, H. Rai-SC; *Sahlgrenska University Hospital, Goteborg, Sweden:* B. Andersson-PI, A. Janssen-SC; *Hamilton Health Sciences, Hamilton, Canada:* A. Lamy-PI, C. Demers-LC, T. Rizzo-SC; *Herzzentrum Leipzig, Leipzig, Germany:* T. Doenst-PI, J. Garbade-LS, H. Thiele-LC, M. Richter-SC; *Glasgow Royal Infirmary, Glasgow, United Kingdom:* M. Petrie-PI, A. Murday-LS, M. Shaw-SC; *CARE Hospital, Hyderabad, India:* K. Raju-PI, G. Mannam-LS, G. Reddy-LC, K. Rao-SC; *Instituto do Coracão (InCor) - HC/FMUSP, Sao Paulo, Brazil:* J. Nicolau-PI, N. Stolf-LS, A. Vieira-SC; *National Heart Centre Singapore, Singapore: Y.*L. Chua-PI, C.H. Lim-LS, B. Kwok-LC, Y.C. Gan-SC; *Castle Hill Hospital, Cottingham, United Kingdom:* J. Cleland-PI, A. Cale-LS, S. Thackray-LC, M. Lammiman-SC; *Montefiore Medical Center/Albert Einstein College of Medicine, New York, USA:* R. Michler-PI, R. Swayze-SC; *Medical University of Vienna, Vienna,*

Austria: G. Maurer-PI, M. Grimm-LS, I. Lang-LC, C. Adlbrecht-SC; *Mayo Clinic, Rochester, USA:* R. Daly-PI, R. Rodeheffer-LC, S. Nelson-SC; *Royal Perth Hospital, Perth, Australia:* R. Larbalestier-PI, X. Wang-SC; *Ottawa Heart Institute, Ottawa, Canada:* H. Haddad-PI, P. Hendry-LS, J. Donaldson-SC; *IRCCS Policlinico San Donato, Milano, Italy:* L. Menicanti-PI, M. Di Donato-LC, S. Castelvecchio-SC; *Vilnius University Hospital, Vilnius, Lithuania:* V. Sirvydis-PI, E. Voluckiene-SC; *S. Giovanni Di Dio Ruggi D Aragona Hospital, Salerno, Italy:* G. Di Benedetto-PI, T. Attisano-SC; *University Hospital Favaloro Foundation, Buenos Aires, Argentina:* R. Favaloro-PI, L. Favaloro-LC, M. Diez-LC; *Hospital Argerich, Buenos Aires, Argentina:* M. Riccitelli-PI, V. Picone-LS, P. Koslowski-LC, M. Gaito-SC; *Northern General Hospital, Sheffield, United Kingdom:* A. Al-mohammad-PI, P. Braidley-LS, H. Steele-SC; *Chiang Mai University Hospital, Chiang Mai, Thailand:* W. Nawarawong-PI, S. Woragidpoonpol-LS, S. Kuanprasert-LC, W. Mekara-SC; *Wake Forest University Health Sciences, Winston-Salem, USA:* N. Kon-PI, J. Hammon-LS, G. Wells-LC, W. Tilley-SC; *University of Texas Southwestern Medical Center, Dallas, USA:* M. Drazner-PI, M. DiMaio-LS, S. Peschka-SC; *Flinders Medical Centre, Adelaide, Australia:* C. De Pasquale-PI, J. Knight-LS, P. Aylward-LC, C. Thomas-SC; *Rikshospitalet HF, Oslo, Norway:* L. Gullestad-PI, G. Sorensen-SC; *Fortis Hospital Noida, Noida, India:* U. Kaul-PI, R. Gupta-SC; *Roanoke Heart Institute, Roanoke, USA:* J. Schmedtje, Jr.-PI, S. Arnold-LS, V. Wilson-SC; *Baylor University Medical Center, Dallas, USA:* P. Grayburn-PI, B. Hamman-LS, R. Hebeler-LS, S. Aston-SC; *Boston V.A. Healthcare System, West Roxbury, USA:* V. Birjiniuk-PI, M. Harrington-SC; *University of North Carolina, Chapel Hill, USA:* C. Dupree-PI, B. Sheridan-LS, C. Schuler-SC; *Hotel-Dieu du CHUM, Montreal, Canada: B. Coutu-PI,* J. Helou-LS, I. Denis-SC; *Casa De Galicia, Montevideo, Uruguay:* D. Bigalli-PI, F. Gutierrez-LS, N. Russo-LC, C. Batlle-SC; *Auckland City Hospital, Auckland, New Zealand:* H. White-PI, P. Alison-LS, R. Stewart-LC, L. Borthwick-SC; *Boston Medical Center, Boston, USA:* G. Philippides-PI, R. Shemin-LS, C. Fitzgerald-SC; *Laval Hospital, Sainte Foy, Canada:* F. Dagenais-PI, G. Dussault-SC; *Amrita Institute of Medical Sciences and Research Centre, Kochi, India:* P. Kamath-PI; *National Medical Center, Budapest, Hungary:* C. Busmann-PI; *Hospital Britanico de Buenos Aires Argentina, Buenos Aires, Argentina:* G. Ferrari-PI, M. Botto-SC; *Semmelweis University, Budapest, Hungary:* F. Horkay-PI, I. Hartyanszky-LS, E. Bartha-LC; *Pecs University, Faculty of Medicine, Heart Clinic, Pecs, Hungary:* T. Simor-PI, L. Papp-LS, L. Toth-LC, A. Varga-Szemes-SC; *George Gottsegen National Institute of Cardiology, Budapest, Hungary:* F. Horkay-PI, L. Szekely-LS, M. Keltai-LC; *University of Debrecen, Medical and Health Science Center, Debrecen, Hungary:* I. Edes-PI, V. Szathmarine-SC; *National Heart Institute, Kuala Lumpur, Malaysia:* M. Yakub-PI, S. Sarip-SC; *Foothills Medical Centre, Calgary, Canada:* A. Maitland-PI, D. Isaac-LC, M. Holland-SC; *University of Szeged, Szeged, Hungary:* G. Bogats-PI, L. Csepregi-SC; *Hospital de Base da Faculdade de Medicina de Sao Jose Rio Preto, Sao Jose do Rio Preto, Brazil:* L. Maia-PI, M. Soares-LS, O. Mouco-LC, A. Souza-SC; *Instituto Nacional de Cardiologia, Rio de Janeiro, Brazil:* A. Cordeiro da Rocha-PI, J. Reis Brito-LS, F. Monassa Pitella-LC, A. Gurgel Camara-SC; *The Queen Elizabeth Hospital, Adelaide, Australia:* J. Horowitz-PI, J. Knight-LS, J. Rose-SC; *Heartcare Mid West, Peoria, USA:* R. McRae, Jr.-PI, D. Geiss-LS, B. Clemson-LC, M. Pierson-SC; *University of Virginia Health System, Charlottesville, USA:* I. Kron-PI, J. Kern-LS, J. Bergin-LC, J. Phillips-SC; *Sentara Norfolk General Hospital/Sentara Heart Hospital, Norfolk, USA:* J. Rich-PI, J. Herre-LC, L. Pine-SC; *University Hospitals of Leicester-Glenfield Hospital, Leicester, United Kingdom:* D. Chin-PI, T. Spyt-LS, E. Logtens-SC; *Hospital Privado Cordoba, Cordoba, Argentina:* L. Amuchastegui-PI; *Hospital Italiano de Buenos Aires, Buenos Aires, Argentina:* D. Bracco-PI; *Bangkok Heart Hospital, Bangkok, Thailand:* P. Ruengsakulrach-PI, V. Pitiguagool-LS, P. Sukhum-LC, D. Srinualta-SC; *St.*

Vincent's Hospital, Darlinghurst, Australia: C. Hayward-PI, C. Herrera-SC; *Regina General Hospital, Regina, Canada:* R. Zimmermann-PI, Gisele Patterson-SC, W. Stephens-SC; *Liverpool Hospital, Liverpool, Australia:* R. Dignan-PI, J. French-LC, N. Sequalino-SC; *Asian Heart Institute, Mumbai, India:* S. Vaishnav-PI, R. Panda-LS, A. Chavan-SC; *Kaunas Medical University Clinics, Kaunas, Lithuania:* R. Benetis-PI, L. Jankauskiene-SC; *Fundacao Universitaria de Cardiologia, Porto Alegre, Brazil:* R. Kalil-PI, I. Nesralla-LS, M. Santos-LC, M. de Moraes-SC; *Martin Luther University, Halle, Germany:* I. Friedrich-PI, M. Buerke-LC, A. Paraforos-SC; *Saint Mary's Duluth Clinic Health System, Duluth, USA:* S. Konda-PI, C. Leone-SC; *Portland V.A. Medical Center, Portland, USA:* E. Murphy-PI, P. Ravichandran-LS, K. Avalos-SC; *German Heart Centre Berlin/University Charite, Berlin, Germany:* R. Hetzer-PI, C. Knosalla-LS, K. Hoffmann-SC; *Medical College of Georgia, Augusta, USA:* K. Landolfo-PI, C. Landolfo-LC, M. Park-SC; *Policlinico Tor Vergata of Rome, Rome, Italy:* L. Chiariello-PI, P. Nardi-SC; *Robert Packer Hospital, Sayre, USA:* D. Stapleton-PI, K. Hoey-SC; *Loma Linda University Medical Center, Loma Linda, USA:* N. Hasaniya-PI, N. Wang-LS; *New York Presbyterian Hospital, New York, USA:* R. Bijou-PI, Y. Naka-LS, D. Ascheim-LC; *Michael E. DeBakey V.A. Medical Center, Houston, USA:* I. Mikati-PI; *London Health Sciences Center - Victoria Campus, London, Canada:* M. Arnold-PI, N. McKenzie-LS, J. Smith-SC; *Northwestern University, Chicago, USA:* M. Gheorghiade-PI, D. Fullerton-LS, L. Roberts-SC.

Trial Committees* - CEC Endpoint Committee:** P. Carson (chair), C. Dupree, A.Miller, I. Pina, C. Selzman, J. Wertheimer; **Data and Safety Monitoring Board:** S. Goldstein (chair), F. Cohn, M. Hlatky, K. Kennedy, S. Rankin, R. Robbins, B. Zaret; **Executive Council:** J. Rouleau (chair), T. Barfield, P. Desvigne-Nickens, R.Jones, K. Lee, R. Michler, C. O'Connor, J. Oh, G. Rankin, G. Sopko, E. Velazquez; **Policy and Publication Committee:** J. Hill (chair), R. Bonow, P. Desvigne-Nickens, T. Doenst, R. Jones, K. Lee, R. Michler, J. Oh, J. Panza, J. Rouleau, Z.Sadowski, G. Sopko, E. Velazquez, H. White. ***Core Laboratories and Ancillary Studies – **Cardiac Magnetic Resonance Core Laboratory:** G. Pohost (director), S. Agarwal, P. Apte, M. Doyle, J. Forder, M. Ocon, R. Pai, V. Reddy, N. Santos, R. Tripathi, P. Varadarajan; **Echocardiography Core Laboratory:** J. Oh (director), P. Pellikka, F. Miller, Jr., G. Lin, D. Borgeson, S. Ommen, G. Casaclang-Verzosa, D. Miller, R. Springer, F.Blahnik, B. Manahan, J. Welper, H. Wiste; **Economics and Quality of Life Core Laboratory:** D. Mark (director), K. Anstrom, K. Baloch, A. Burnette, P.Cowper, N. Davidson-Ray, L. Drew, T. Harding, V. Hunt, D. Knight, A.Patterson, T. Redick, B. Sanderford; **Neurohormone-Cytokine-Genetics Core Laboratory:** A. Feldman (director), M. Bristow, T. Chan, A.Maisel, D. Mann, D. McNamara; **Radionuclide Core Laboratory:** R. Bonow (director), T. Holly, D. Berman, S. Leonard, D. Helmer, M. Woods; **DECIPHER Ancillary Study:** J. Panza (director), M. McNulty, F. Asch, M. Rumsey, S. Bieganski; **MR TEE Ancillary Study:** P. Grayburn (director), S. Aston, B. Roberts, M. Handschumacher.

***Leadership and Management Teams* - Coordinating Center Clinical Leadership**: R. Jones, E. Velazquez, C. O'Connor; **Project Management:** G. Rankin, T. Barfield; **Site Management:** A. McCormick, J. Albright, R. Dandridge, L. Rittenhouse; **Data Management:** D. Wagstaff, M. Williams, D. Bailey, D. Glover, L. Parrish, N. Wakeley, V. Jackson, B. Nicholson; **Statistics:** K. Lee, L. She, A. McDaniel, H. Al-Khalidi; **Clinical Events Coordination:** D. Greene; **Project Support:** V. Moore.

METHODS

Risk at Randomization Score

A risk at randomization (RAR) score was calculated for each of the 1212 patients using an equation derived in an independent dataset from multiple variables with known power to predict 5-year risk of death without CABG [1]. Three Duke Databank for Cardiovascular Diseases CAD prognosis publications [2-4] identified candidate variables that were used to create a Cox multivariable regression equation predictive of time to death in 821 patients in the Duke Databank for Cardiovascular Diseases who fulfilled enrollment criteria for STICH but were not enrolled in the trial. Prognostic baseline clinical variables in descending order of importance for predicting time to death in this cohort over a mean follow-up of 5 years were age, renal disease (creatinine ≥1.5 mg/dl), heart failure, ejection fraction, Duke CAD index, mitral insufficiency, and cerebrovascular disease (Table S1). Individual STICH patient baseline values for these variables entered into the multivariable equation produced a predicted 5-year probability of death for each STICH patient if treated medically that ranged from 0.184 to 0.989 [1].

Imaging to Assess Myocardial Viability

In the initial design of the STICH Trial, implemented in 2002, viability testing with SPECT was required for patient enrollment [5]. However, this proved to be too complex for many sites and was an impediment to enrollment. The protocol was subsequently revised in 2004 to make viability testing optional using either SPECT or dobutamine echocardiography (DE), depending on the availability of the techniques and expertise at each recruiting center. Contributing sites were strongly encouraged to obtain viability tests in every patient, but the decision to perform the test was left up to the recruiting investigators.

Of the 1212 randomized patients, 618 (51%) underwent imaging to assess myocardial viability using either SPECT or DE. Nine patients in whom the viability test was performed greater than 90 days before or after randomization were excluded from analysis, another 6 patients were excluded because of poor image quality, and 2 additional patients were excluded in whom the viability test was performed after CABG. Thus, viability data in 601 of the 1212 randomized patients (49.6%) form the basis of this report. This includes 471 patients studied by SPECT and 280 by DE, of whom 150 were studied by both methods. The viability test was performed before randomization in 170 patients, on the day of randomization in 69 patients, and after randomization in 362 patients. Those with a viability test after randomization in the surgical arm all had viability testing performed before surgery. The trial protocol was approved by the ethics committee at each

enrolling center. All patients provided written informed consent

Independently funded core laboratories [6] blinded to patient details and treatment assignment coordinated data collection and analysis for the SPECT and DE studies. Thresholds of dysfunctional but viable myocardium by SPECT and DE were pre-specified to identify patients with and without substantial myocardial viability. These prespecified analytic methods were approved by the STICH Data and Safety Monitoring Committee. Core laboratory measurements were submitted to the Duke Clinical Research Institute which performed all statistical analyses.

Single photon emission computed tomography. Four different clinically validated SPECT protocols for assessing myocardial viability were permitted at the enrolling sites. These included thallium imaging using a rest-redistribution or stress-rest-reinjection protocol [7], rest-redistribution thallium imaging as part of a dual isotope protocol with a technetium-99m perfusion tracer [8], or imaging with a technetium-99m tracer at rest after the administration of nitroglycerin [9]. Images were stored digitally and sent to the STICH Radionuclide Core Laboratory at Northwestern University for analysis. Core laboratory measurement of regional tracer activity was performed on all SPECT studies using a 17 segment model of the left ventricle [10]. A myocardial segment was deemed viable if the tracer activity was ≥50% of the activity in the segment with maximal activity. For thallium rest-redistribution imaging, a segment with activity <50% of the maximal myocardial activity on the redistribution images was also defined as viable if the improvement in activity from the rest to redistribution images was ≥12%. Myocardial viability on a per-patient basis was prospectively defined as the presence of ≥11 viable segments (≥65% of the entire left ventricle). When ≥7 segments were nonviable (≥41% of the left ventricle), the patient was considered to have insufficient mass of viable myocardium. This threshold was selected based on previous retrospective data indicating that the likelihood for functional improvement after CABG is low when >40% of the left ventricular (LV) myocardium is nonviable [11].

Dobutamine echocardiography. Following standard procedures, two-dimensional echocardiographic images were obtained at rest and during incrementally higher doses of dobutamine starting at 5 µg/kg/min and increasing to 10, 20, 30 and 40 µg/kg/min in 3-5 minute stages. The core laboratory divided the left ventricle into 16 segments according to the recommendations of the American Society of Echocardiography [12]. Segments with baseline hypokinesia, akinesia or dyskinesia were considered dysfunctional. Dysfunctional segments were considered viable when demonstrating with incremental doses of dobutamine a biphasic response (improvement at lower doses followed by worsening of contraction at higher doses), sustained

improvement (improvement at lower doses without worsening at higher doses), or worsening contractility (only applicable to segments with resting hypokinesis). Dysfunctional segments without appreciable change in contraction during dobutamine infusion were considered not viable. Viability on a per-patient basis was prospectively defined as the presence of contractile reserve in ≥5 of the dysfunctional segments. Previous retrospective studies reporting the association between contractile reserve and survival after revascularization support this threshold [13,14].

Patients studied with both SPECT and dobutamine echocardiography. Both SPECT and DE were performed in 150 patients. Based on the thresholds defined above, when both tests demonstrated viability, the sum of SPECT plus echocardiography scores was ≥16 viable segments; when both tests demonstrated nonviability, the sum was <16. This threshold was then applied for those with discordant results between the two tests; the SPECT viability score and DE viability score were added together, and patients were considered to have viable myocardium when the total segment score was ≥16.

Comparison of SPECT and dobutamine echocardiography methodologies. SPECT and DE differ fundamentally in the information they provide regarding the presence and extent of viable myocardium. Retention of SPECT tracers in the myocardium provides information regarding intact cellular membrane activity [7], whereas DE establishes evidence of viability in dysfunctional regions of the left ventricle by eliciting contractile reserve [13,14]. The methods also differ with respect to the paths taken by previous investigators to establish the standard analytic approaches. A strength of the DE method is direct visualization of the regions with contractile dysfunction and assessment of their response to inotropic stimulation, and this has been the basis for numerous studies reporting improved survival in patients with contractile reserve who undergo CABG compared to medical management [13-24]. In contrast, SPECT is much less amenable to assessing viability within dysfunctional zones because of its lower spatial resolution and has been reported to have prognostic power in its assessment of the amount of overall viable versus nonviable tissue. This global method is the basis for 13 of the 14 previous SPECT studies reporting that patients with viable myocardium have a survival advantage with CABG compared to medical therapy alone [25-38]. Because of the challenges in combining both SPECT and DE data in this paper, we report the relationship of myocardial viability and outcomes using the combined approach noted above and also for each imaging method individually.

Analytic Methods

The examination of the association between myocardial viability and outcome relative to

treatment assignment (intention to treat) was performed using three separate pre-specified analyses. In the first and primary analysis, patients were subgrouped according to the pre-specified definitions for myocardial viability noted previously. Recognizing the potential limitations of this approach, which has never been tested in a prospective trial, we also performed two other separate analyses. In the second analysis, patients were subdivided according to the median viability score for SPECT or DE (or for the combined score in those with both tests). In the third analysis, both the SPECT viability scores and the DE scores were analyzed as continuous rather than dichotomous variables. In each case, the interaction between viability status and treatment effect on outcome was tested using the Cox model.

RESULTS

Baseline Characteristics

Comparison of the 601 patients with an acceptable viability test with the other 611 patients enrolled in Hypothesis 1 of the STICH trial is shown in Table S2. Patients with viability tests had evidence of more severe LV dysfunction, with lower LV ejection fractions and greater end-diastolic and end-systolic volume indexes. In keeping with this finding, patients undergoing testing had a higher prevalence of prior myocardial infarction, had more frequently undergone prior percutaneous coronary interventions, and were more frequently treated with beta blockers, angiotensin-converting enzyme (ACE) inhibitors/angiotensin receptor blockers, statins and aspirin. Patients undergoing viability testing had less severe Canadian Cardiovascular Society angina class. Patients undergoing testing also differed by race/ethnicity, with fewer Asian patients studied (reflecting enrollment in India). However, the two groups did not differ with respect to the RAR score, which incorporates many comorbidities, as noted above.

The median time (25th, 75th percentile) between viability testing and randomization was 5 days (2,11) for the SPECT studies and 4 days (1,7) for the DE studies. Viability testing was performed before randomization in 170 patients, on the day of randomization in 69 patients, and after the day of randomization in 362 patients. Baseline characteristics of these patients are presented in Table S3, in which patients tested on the day of randomization are combined with those tested after randomization. A slightly higher proportion of patients studied on the day of or after randomization were assigned to CABG than those studied before randomization. It is conceivable that, for patients studied after randomization, the decision to obtain a viability test could have been based on knowledge of the treatment assignment. However, the difference in assignment of those tested before versus after randomization was not statistically significant.

Furthermore, this difference seems likely to be the result of chance variation, because overall, patients in the trial were randomly allocated to the treatment arms in equal proportions. Subsequent crossover rates within the first year of randomization were not related to timing of viability testing relative to randomization.

As noted previously, viability testing was performed using SPECT in 471 patients and using DE in 280 patients, with 150 patients studied by both methods. The method of testing did not differ between patients assigned to CABG and those assigned to medical therapy (Table S4). As indicated in Table S4, of the 601 patients with viability tests, 298 were assigned to CABG and 303 were assigned to medical therapy alone. These groups were well matched, with no significant differences in baseline characteristics. The mean age was 60.7±9.4 years, and 521 (87%) were men. Eighty percent of patients had a previous myocardial infarction, and the mean LV ejection fraction was 26.7±8.6%. The population had substantial CAD; 73% had 2 or more major coronary arteries with 75% or greater stenosis, and 65% had a 75% or greater stenosis of the proximal left anterior descending coronary artery. Symptomatic heart failure within 3 months of randomization was present in 96%, with 362 patients (60%) having New York Heart Association (NHYA) class III or IV heart failure. Medical therapy for CAD and heart failure at enrollment was excellent, with 92% receiving an angiotensin-converting enzyme inhibitor or angiotensin-receptor blocking agent, 89% a beta blocker, 85% aspirin, and 85% a statin agent. These high rates of treatment continued throughout the trial [6].

The viability tests identified 487 patients with myocardial viability using the pre-specified SPECT and DE criteria (Table S5). Patients with viable myocardium had fewer previous myocardial infarctions but a greater prevalence of diabetes and hypertension. The RAR score did not differ between the two groups. However, patients with viable myocardium had significantly higher LV ejection fractions and smaller end-diastolic and end-systolic volume indices than those without viable myocardium. The propensity model identified higher ejection fraction ($p<0.0001$), fewer prior myocardial infarctions ($p<0.0001$), higher systolic blood pressure ($p=0.001$), and diabetes ($p=0.007$) as significant variables associated with the presence of viable myocardium. There were also insignificant trends indicating, for the group, less severe heart failure symptoms and less severe angina in patients with myocardial viability. Baseline characteristics of patients who underwent viability testing according to treatment assignment are presented in Tables 1 and S6.

Outcomes

There were 236 total deaths in the 601 patient population (39% mortality) over a median follow up period of 5.1 years. Patients with myocardial viability had lower overall mortality rates than those without viable myocardium (HR 0.64; 95% CI 0.48,0.86; p=0.003). Several other clinical variables known to be associated with mortality, including LV ejection fraction, end-diastolic volume index, end-systolic volume index, and the RAR score all were more significantly associated with mortality than viability status (Table S7). After adjustment for other significant baseline prognostic variables in a multivariable model, the pre-specified viability status was no longer significantly associated with mortality (Table S8). Similar trends were observed when outcome was assessed for SPECT data alone or DE data alone (Table S8).

Patients with myocardial viability also had lower rates of the secondary endpoints of cardiovascular mortality (HR 0.61; 95% CI 0.44,0.84; p=003) and mortality plus cardiovascular hospitalization (HR 0.59; 95% CI 0.47,0.74; p<001), as shown in Figure S1. The relationship with cardiovascular mortality was nonsignificant when subjected to multivariable analysis (p=0.339) but remained significant for mortality plus cardiovascular hospitalization (p=0.003).

Further analyses based on the subgrouping of patients according to the median values of viability scores or based on analysis of the viability score as a continuous variable revealed similar trends but with less significant results than those obtained using the pre-specified viability analysis described above. These analyses revealed no significant interaction between myocardial viability and assignment to CABG or medical therapy related to mortality, whether examined for all patients with viability tests, those with SPECT data alone, or those with DE data alone.

Secondary outcomes. As shown in Table S9, no significant interaction was observed between viability status and treatment assignment for the secondary outcomes of cardiovascular mortality (p=0.697) or mortality plus cardiovascular hospitalization (p=0.390).

Analysis based on treatment received. Of the 601 patients with viability tests, 31 of the 303 (10.2%) patients assigned to medical therapy crossed over to CABG within 12 months of randomization, and 19 of the 298 (6.4%) patients assigned to CABG did not undergo CABG. Thus, within 12 months after randomization, 310 (51.6%) patients actually received CABG plus medical therapy while the other 291 (48.4%) patients received medical therapy only. To assess the influence of myocardial viability on outcome based on actual treatment received, the analyses described above were repeated based on the treatment received (Figure S3). There was no significant interaction between viability and treatment with respect to mortality (p=0.962).

References

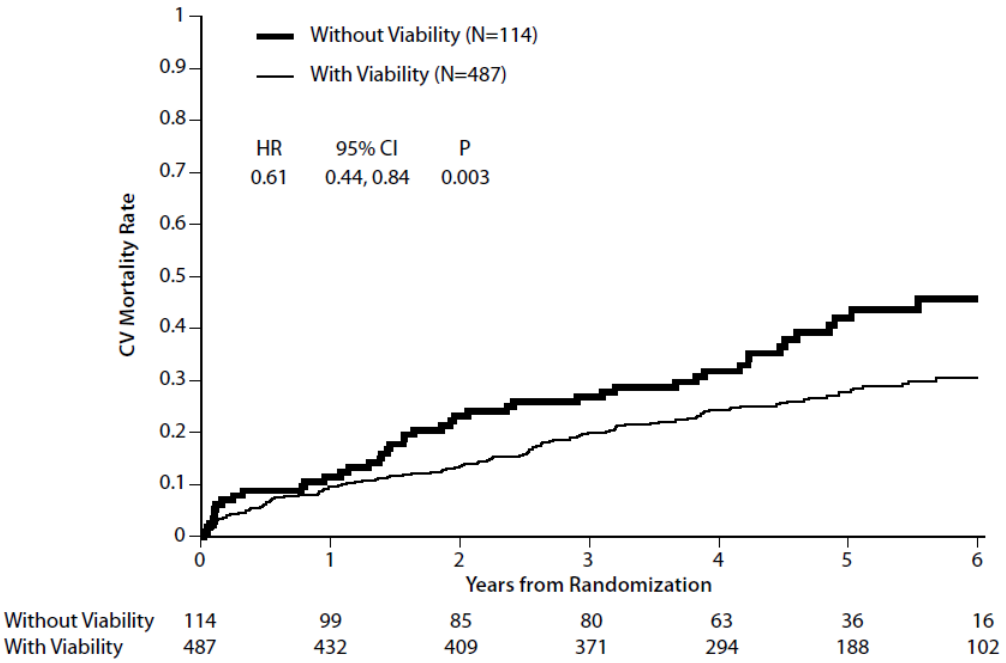
1. Jones RH, White H, Velazquez EJ, et al. STICH (Surgical Treatment for Ischemic Heart Failure) trial enrollment. J Am Coll Cardiol 2010;56:490-8.
2. Califf RM, Harrell FE Jr., Lee KL, et al. The evolution of medical and surgical therapy for coronary artery disease: a 15-year perspective. JAMA. 1989;261:2077-86.
3. Jones RH, Kesler KK, Phillips HR III, et al. Long-term survival benefit of coronary artery bypass grafting and percutaneous transluminal angioplasty in patients with coronary artery disease. J Thorac Cardiovasc Surg. 1996;111:1013-25.
4. Smith PK, Califf RM, Tuttle RH, et al. Selection of surgical or percutaneous coronary intervention provides differential longevity benefit. Ann Thorac Surg. 2006;82:1402-29.
5. Velazquez EJ, Lee KL, O'Connor CM, et al. The rationale and design of the Surgical Treatment for Ischemic Heart Failure (STICH) Trial. J Thorac Cardiovasc Surg. 2007;134:1540-7.
6. Velazquez EJ, Lee KL, Deja MA, et al. Coronary artery bypass surgery in patients with left ventricular dysfunction. (submitted for publication).
7. Dilsizian V, Bonow RO: Current diagnostic techniques of assessing myocardial viability in hibernating and stunned myocardium. Circulation. 1993;87:1-20.
8. Berman DS, Kiat H, Friedman J, et al. Separate acquisition rest Tl-201/stress Tc-99m sestamibi dual isotope myocardial perfusion SPECT: a clinical validation study. J Am Coll Cardiol. 1993;22:1455-64.
9. Sciagra R, Bisi G, Santoro GM, et al. Comparison of baseline-nitrate technetium-99m sestamibi with rest-redistribution thallium-201 tomography in detecting viable hibernating myocardium and predicting postrevascularization recovery. J Am Coll Cardiol. 1997;30:384-91.
10. Cerqueira MD, Weissman NJ, Dilsizian V, et al. Standardized myocardial segmentation and nomenclature for tomographic imaging of the heart: a statement for healthcare professionals from the Cardiac Imaging Committee of the Council on Clinical Cardiology of the American Heart Association. Circulation. 2002;105:539-42.
11. Ragosta M, Beller GA, Watson DD, Kaul S, Gimple LW. Quantitative planar rest-redistribution 201Tl imaging in detection of myocardial viability and prediction of improvement in left ventricular function after coronary bypass surgery in patients with severely depressed left ventricular function. Circulation. 1993;87;1630-41.
12. Schiller NB, Shah PM, Crawford M, et al. Recommendations for quantitation of the left ventricle by two-dimensional echocardiography. American Society of Echocardiography Committee on Standards, Subcommittee on Quantitation of Two-Dimensional Echocardiograms. J Am Soc Echocardiogr. 1989;2:358-67.
13. Senior R, Kaul S, Lahiri A. Myocardial viability on echocardiography predicts long term survival after revascularization in patients with ischaemic congestive heart failure. J Am Coll Cardiol. 1999;33:1848-54.
14. Chaudhry FA, Tauke JT, Alessandrini RS, Vardi G, Parker MA, Bonow RO. Prognostic implications of myocardial contractile reserve in patients with coronary artery disease and left

ventricular dysfunction. J Am Coll Cardiol. 1999;34:730-8.

15. Williams MJ, Odabashian J, Lauer MS, Thomas JD, Marwick TH. Prognostic value of dobutamine echocardiography in patients with left ventricular dysfunction. J Am Coll Cardiol. 1996;27:132-9.
16. Afridi I, Grayburn PA, Panza JA, Oh JK, Zoghbi WA, Marwick TH. Myocardial viability during dobutamine echocardiography predicts survival in patients with coronary artery disease and severe left ventricular systolic dysfunction. J Am Coll Cardiol. 1998;32:921-6.
17. Anselmi M, Golia G, Cicoira M, et al. Prognostic value of detection of myocardial viability using low-dose dobutamine echocardiography in infarcted patients. Am J Cardiol. 1998;81:21G-8G.
18. Senior R, Kaul S, Lahiri A. Myocardial viability on echocardiography predicts long-term survival after revascularization in patients with ischemic congestive heart failure. J Am Coll Cardiol. 1999;33:1848-54.
19. Chaudhry FA, Tauke JT, Alessandrini RS, Vardi G, Parker MA, Bonow RO. Prognostic implications of myocardial contractile reserve in patients with coronary artery disease and left ventricular dysfunction. J Am Coll Cardiol. 1999;34:730-8.
20. Sicari R, Ripoli A, Picano E, et al. The prognostic value of myocardial viability recognized by low dose dipyridamole echocardiography in patients with chronic ischaemic left ventricular dysfunction. Eur Heart J. 2001;22:837-44.
21. Sicari R, Picano E, Cortigiani L, et al. Prognostic value of myocardial viability recognized by low-dose dobutamine echocardiography in chronic ischemic left ventricular dysfunction. Am J Cardiol. 2003;92:1263-6.
22. Meluzin J, Cerny J, Spinarova L, et al. Prognosis of patients with chronic coronary artery disease and severe left ventricular dys function: the importance of myocardial viability. Eur J Heart Fail. 2003;5:85-93.
23. Liao L, Cabell CH, Jollis JG, et al. Usefulness of myocardial viability or ischemia in predicting long-term survival for patients with severe left ventricular dysfunction undergoing revascularization. Am J Cardiol. 2004;93:1275-9.
24. Sawada SG, Dasgupta S, Nguyen J, et al. Effect of revascularization on long-term survival in patients with ischemic left ventricular dysfunction and a wide range of viability. Am J Cardiol. 2010;106:187-92.
25. Gioia G, Powers J, Heo J, Iskandrian AS. Prognostic value of rest-redistribution tomographic thallium-201 imaging in ischemic cardiomyopathy. Am J Cardiol. 1995;75:759-62.
26. Gioia G, Milan E, Giubbini R, DePace N, Heo J, Iskandrian AS. Prognostic value of tomographic rest-redistribution thallium 201 imaging in medically treated patients with coronary artery disease and left ventricular dysfunction. J Nucl Cardiol. 1996;3:150-6.
27. Pagley PR, Beller GA, Watson DD, Gimple LW, Ragosta M. Improved outcome after coronary bypass surgery in patients with ischemic cardiomyopathy and residual myocardial viability. Circulation. 1997;96:793-800.
28. Petretta M, Cuocolo A, Bonaduce D, et al. Incremental prognostic value of thallium reinjection after stress-redistribution imaging in patients with previous myocardial infarction

and left ventricular dysfunction. J Nucl Med. 1997;38:195-200.

29. Cuocolo A, Petretta M, Nicolai E, et al. Successful coronary revascularization improves prognosis in patients with previous myocardial infarction and evidence of viable myocardium at thallium-201 imaging. Eur J Nucl Med. 1998;25:60-8.
30. Pasquet A, Robert A, D'Hondt AM, Dion R, Melin JA, Vanoverschelde JL. Prognostic value of myocardial ischemia and viability in patients with chronic left ventricular ischemic dysfunction. Circulation. 1999;100:141-8.
31. Morse RW, Noe S, Caravalho J Jr, Balingit A, Taylor AJ. Rest-redistribution 201Tl single-photon emission CT imaging for determination of myocardial viability: relationship among viability, mode of therapy, and long-term prognosis. Chest. 1999;115:1621-6
32. Shapira I, Heller I, Pines A, Topilsky M, Isakov A. The impact of myocardial viability as determined by rest-redistribution 201Tl single photon emission CT imaging and the choice of therapy on prognosis in patients with left ventricular dysfunction. J Med. 2000;31:205-14.
33. Sciagra R, Pellegri M, Pupi A, et al. Prognostic implications of Tc-99m sestamibi viability imaging and subsequent therapeutic strategy in patients with chronic coronary artery disease and left ventricular dysfunction. J Am Coll Cardiol. 2000;36:739-45.
34. Senior R, Kaul S, Raval U, Lahiri A. Impact of revascularization and myocardial viability determined by nitrate-enhanced Tc-99m sestamibi and Tl-201 imaging on mortality and functional outcome in ischemic cardiomyopathy. J Nucl Card. 2002; 9:454-62.
35. Podio V, Spinnler MT, Bertuccio G, Carbonero C, Pelosi E, Bisi G. Prognosis of hibernating myocardium is independent of recovery of function: evidence from a routine based follow-up study. Nucl Med Comm. 2002;23:933-42.
36. He Z-X, Yang M-F, Liu X-J, et al. Association of myocardial **v**iability on nitrate-augmented technetium-99m hexakis-2-methoxylisobutyl isonitrile myocardial tomography and intermediate-term outcome in patients with prior myocardial infarction and left ventricular dysfunction. Am J Cardiol. 2003;92:696-9.
37. Petrasinovic Z, Ostojic M, Beleslin B, et al. Prognostic value of myocardial viability determined by a201Tl SPECT study in patients with previous myocardial infarction and mild-to-moderate myocardial dysfunction. Nucl Med Commun. 2003;24:175-81.
38. Hage FG, Venkataraman R, Aljaroudi W, et al. The impact of viability assessment using myocardial perfusion imaging on patient management and outcome. J Nucl Cardiol. 2010;17:378-89.



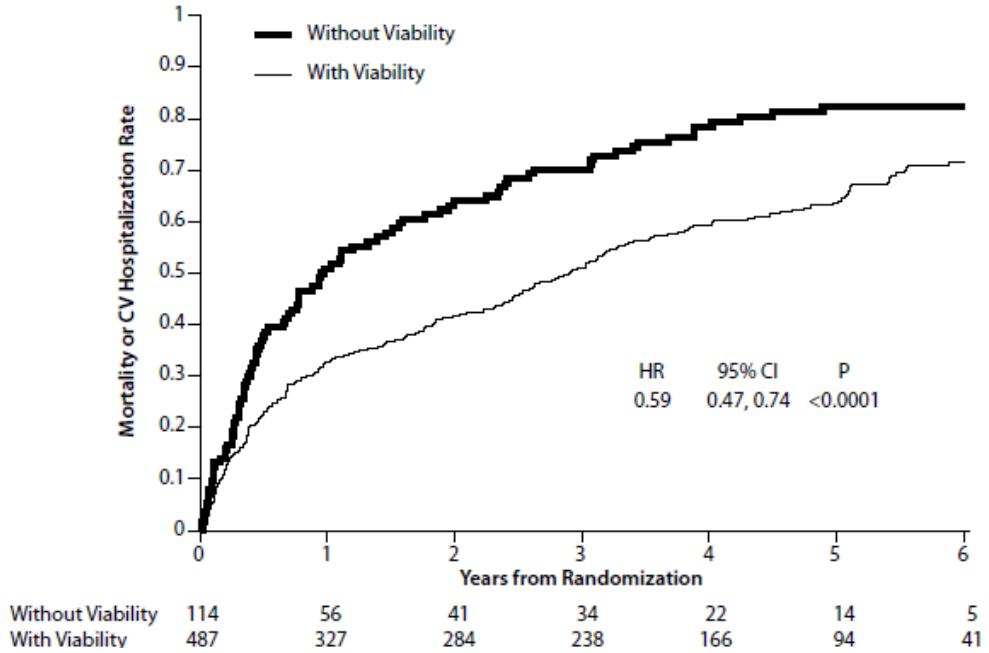


Figure S1. Kaplan-Meier event rate curves for rates of cardiovascular mortality and combined rates of mortality plus cardiovascular hospitalization in patients with viable myocardium and patients without viable myocardium.

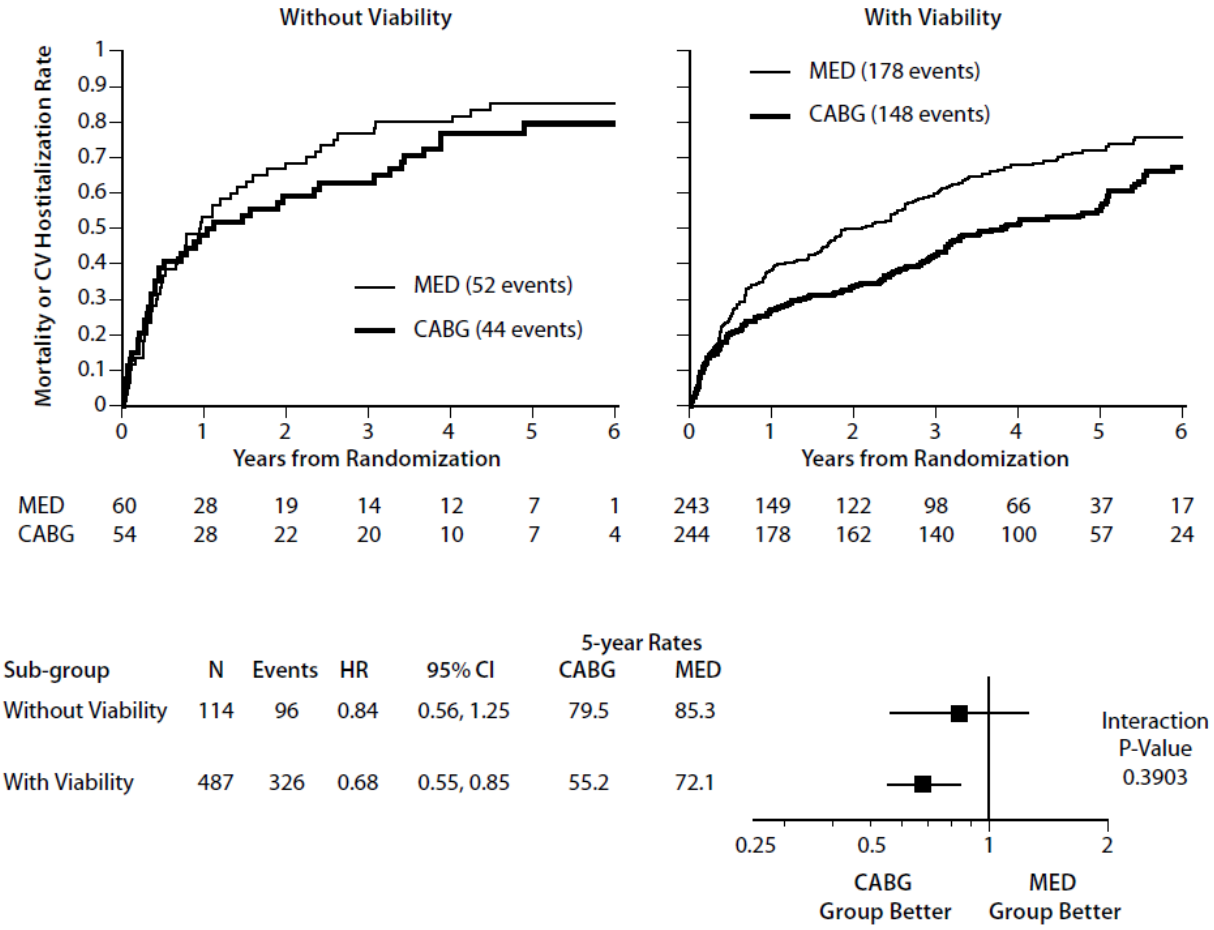


Figure S2. Kaplan-Meier event curves for rates of mortality plus cardiovascular hospitalization and CABG:MED hazard ratios by randomized treatment in patients with and without myocardial viability according to randomized treatment. CABG = coronary artery bypass graft surgery; MED = medical therapy alone.

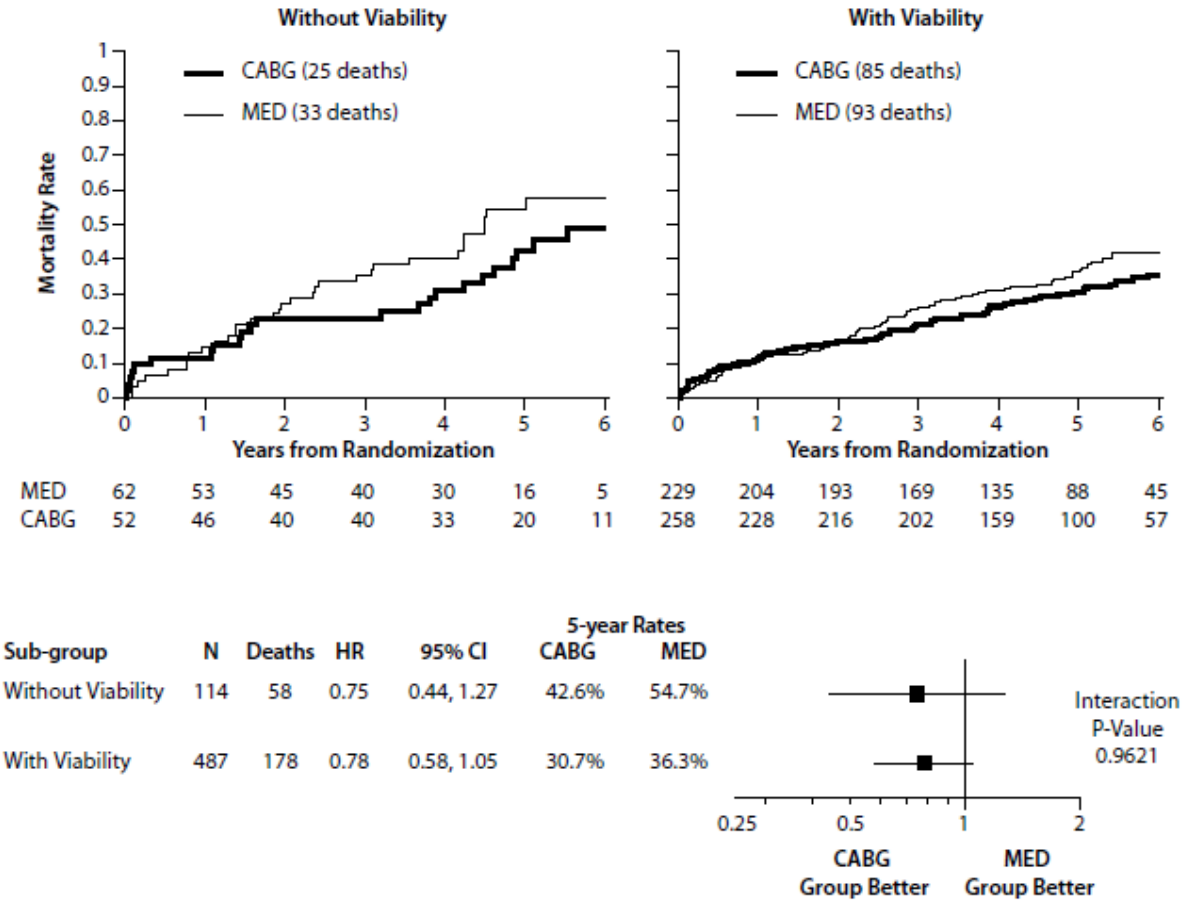


Figure S3. Kaplan-Meier event curves for rates of overall mortality and CABG:MED hazard ratios according to treatment received in patients with and without myocardial viability,.

Table S1. Significant covariates in the Risk at Randomization Multivariable Model

Variable	Parameter estimate	Standard error	Chi-square	P value	Hazard Ratio	Variable definition
Age	0.27836	0.04339	41.1562	<0.001	1.321	Years (HR by 10 yrs)
Renal disease	1.27632	0.26594	23.0321	<0.001	3.583	Creatinine ≥1.5 mg/dl
Heart failure	0.10669	0.02768	14.8579	<0.001	1.113	NYHA functional class
Ejection fraction	-0.11904	0.03190	13.9255	<0.001	0.888	Percent (HR per 5)
CAD index	0.00582	0.00184	10.0175	0.002	1.006	0–100
Mitral regurgitation	0.10521	0.03559	8.7393	0.003	1.111	0 (none) to 4+(severe)
History of CVD	0.26897	0.10504	6.5565	0.015	1.309	Stroke or equivalent

CAD = coronary artery disease; CVD = cerebrovascular disease; NYHA = New York Heart Association

Table S2. Baseline characteristics of patients with and without testing of myocardial viability

Characteristic	All patients (n=1212)	Patients with a viability test (n=601)	Patients without a viability test (n=611)	P value
Age, mean ± SD	60.3 ± 9.3	60.7 ± 9.4	59.9 ± 9.2	0.113
Male, no. (%)	1064 (87.7)	521 (86.7)	543 (88.9)	0.246
Race, no. (%)				<0.001
White	827 (68.2)	496 (82.5)	331 (54.2)	
Black	31 (2.6)	18 (3.0)	13 (2.1)	
Asian	209 (17.2)	29 (4.8)	180 (29.5)	
Other	141 (11.6)	54 (9.0)	87 (14.2)	
Multiracial	4 (0.3)	4 (0.7)	0 (0.0)	
Prior myocardial infarction, no. (%)	934 (77.1)	481 (80.0)	453 (74.1)	0.015
Diabetes, no. (%)	478 (39.4)	224 (37.3)	254 (41.6)	0.126
Stroke, no. (%)	92 (7.6)	53 (8.8)	39 (6.4)	0.109
Hypertension, no. (%)	728 (60.1)	363 (60.4)	365 (59.7)	0.814
Hyperlipidemia, no. (%)	730 (60.3)	403 (67.3)	327 (53.5)	<0.001
Current smoker, no. (%)	252 (20.8)	126 (21.0)	126 (20.7)	0.895
Chronic renal insufficiency, no. (%)	94 (7.8)	43 (7.2)	51 (8.3)	0.443
Atrial flutter/fibrillation, no. (%)	153 (12.6)	90 (15.0)	63 (10.3)	0.015
Peripheral vascular disease,no. (%)	184 (15.2)	91 (15.1)	93 (15.2)	0.969
RAR score, mean ± SD	12.7 ± 8.8	12.5 ± 8.8	12.9 ± 8.8	0.311
Previous CABG, no. (%)	36 (3.0)	16 (2.7)	20 (3.3)	0.531
Bypass graft status, no. (%)				
≥1 stenosed or occluded	35 (97.2)	15 (93.8)	20 (100)	0.444
≥1 occluded	29 (80.6)	14 (87.5)	15 (75.0)	0.426
Previous PCI, no. (%)	156 (12.9)	104 (17.3)	52 (8.5)	<0.001
Previous ICD, no. (%)	29 (2.4)	16 (2.7)	13 (2.1)	0.543
CAD distribution, no. (%)				
No. of diseased vessels ≥75%				0.416
None*	25 (2.1)	12 (2.0)	13 (2.1)	
One-vessel	282 (23.2)	152 (25.3)	130 (21.3)	
Two-vessel	462 (38.2)	221 (36.8)	241 (39.4)	
Three-vessel	442 (36.5)	215 (35.8)	227 (37.2)	
Proximal LAD stenosis ≥75%	826 (68.2)	389 (64.8)	437 (71.5)	0.012
Left main stenosis (≥50%)	32 (2.6)	14 (2.3)	18 (2.9))	0.506
Current CCS angina class, no. (%)				0.023
No angina	442 (36.5)	236 (39.3)	206 (33.7)	
I	187 (15.4)	94 (15.6)	93 (15.2)	
II	525 (43.3)	253 (42.1)	272 (44.5)	
III	48 (4.0)	14 (2.3)	34 (5.6)	
IV	10 (0.8)	4 (0.7))	6 (1.0)	
Highest NYHA functional class within 3 months, no. (%)				0.231
I	69 (5.7)	27 (4.5)	42 (6.9)	
II	438 (36.1)	212 (35.3)	226 (37.0)	
III	540 (44.6)	275 (45.8)	265 (43.4)	
IV	165 (13.6)	87 (14.5)	78 (12.8)	

Medications at baseline, no. (%)				
Beta blocker	1036 (85.5)	534 (88.9)	502 (82.2)	<0.001
ACE inhibitor	996 (82.2)	514 (85.5)	482 (78.9)	0.002
Angiotensin receptor blocker	115 (9.5)	46 (7.7)	69 (11.3)	0.031
ACE inhibitor or ARB	1085 (89.5)	554 (92.2)	531 (86.9)	0.003
Statin	983 (81.1)	508 (84.5)	475 (77.7)	0.003
Aspirin	1002 (82.7)	513 (85.4)	489 (80.0)	0.014
Digoxin	245 (20.2)	109 (18.1)	136 (22.3)	0.074
Blood pressure, mean ± SD				
Systolic (mmHg)	121.2 ± 17.5	119.8 ± 17.3	122.5 ± 17.7	0.003
Diastolic (mmHg)	75.5 ± 11.0	74.7 ± 10.7	76.3 ± 11.3	0.022
Heart rate, mean ± SD	74.9 ± 14.7	73.3 ± 12.9	76.4 ± 16.1	<0.001
LV ejection fraction, mean ± SD	0.279 ± 0.087	0.267 ± 0.086	0.290 ± 0.086	<0.001
LVEDVI (ml/m2), mean ± SD	117.6 ± 39.2	122.8 ± 41.9	110.4 ± 33.9	<0.001
LVESVI (ml/m2), mean ± SD	85.5 ± 36.2	91.7 ± 38.9	78.6 ± 31.6	<0.001
Hemoglobin (g/dL), mean ± SD	13.8 ± 1.7	13.9 ± 1.7	13.6 ± 1.8	0.005
Creatinine (mg/dL), mean ± SD	1.2 ± 0.6	1.2 ± 0.7	1.2 ± 0.5	0.004
BUN (mg/dL), mean ± SD	29.3 ± 21.2	29.2 ± 19.7	29.5 ± 22.3	0.980

*Although some patients had no coronary artery stenosis ≥75%, all patients had a coronary artery with stenosis ≥50%.

ACE = angiotensin converting enzyme; ARB = angiotensin receptor blocker; BUN = blood urea nitrogen; CABG = coronary artery bypass graft surgery; CAD = coronary artery disease; EDVI = end-diastolic volume index; ESVI = end-systolic volume index; ICD = implantable cardioverter defibrillator; LV= left ventricular; NYHA = New York Heart Association; RAR = risk at randomization

Table S3. Baseline characteristics of patients with viability tests before vs. after randomization

Characteristic	All patients with viability testing (n=601)	Patients studied before randomization (n=170)	Patients studied after* randomization (n=431)	P value
Randomized to CABG, no. (%)	298 (49.6)	74 (43.5)	224 (52.0)	0.062
Crossover med to CABG, no. (%)	31 (5.2)	10 (5.9)	21 (4.9)	0.614
Crossover CABG to med, no. (%)	19 (3.2)	3 (1.8)	16 (3.7)	0.219
Received CABG, no. (%)	310 (51.6)	81 (47.6)	229 (53.1)	0.226
Patients with viability, no. (%)	487 (81.0)	141 (82.9)	346 (80.3)	0.453
Age, mean ± SD	60.7 ± 9.4	62.1 ± 8.8	60.2 ± 9.5	0.035
Male, no. (%)	521 (86.7)	147 (86.5)	374 (86.8)	0.921
Race, no. (%)				0.056
White	496 (82.5)	136 (80.0)	360 (83.5)	
Black	18 (3.0)	4 (2.4)	14 (3.2)	
Asian	29 (4.8)	5 (2.9	24 (5.6)	
Other	54 (9.0)	24 (14.1)	30 (7.0)	
Multi-racial	4 (0.7)	1 (0.6)	3 (0.7)	
Prior myocardial infarction, no. (%)	481 (80.0)	134 (78.8)	347 (80.5)	0.641
Diabetes, no. (%)	224 (37.3)	71 (41.8)	153 (35.5)	0.152
Stroke, no. (%)	53 (8.8)	10 (5.9)	43 (10.0)	0.111
Hypertension, no. (%)	363 (60.4)	110 (64.7)	253 (58.7)	0.175
Hyperlipidemia, no. (%)	403 (67.3)	123 (72.4)	280 (65.3)	0.096
Current smoker, no. (%)	126 (21.0)	28 (16.5)	98 (22.7)	0.089
Chronic renal insufficiency, no. (%)	43 (7.2)	16 (9.4)	27 (6.3)	0.180
Atrial flutter/fibrillation, no. (%)	90 (15.0)	27 (15.9)	63 (14.6)	0.695
Peripheral vascular disease,no. (%)	91 (15.1)	31 (18.2)	60 (13.9)	0.184
RAR score, mean ± SD	12.5 ± 8.8	13.6 ± 8.7	12.0 ± 8.8	0.028
Previous CABG, no. (%)	16 (2.7)	3 (1.8)	13 (3.0)	0.575
Previous PCI, no. (%)	104 (17.3)	22 (12.9)	82 (19.0)	0.076
Previous ICD, no. (%)	16 (2.7)	6 (3.5)	10 (2.3)	0.407
CAD distribution, no. (%)				
No. of diseased vessels ≥75%				0.637
None	12 (2.0)	2 (1.2)	10 (2.3)	
One-vessel	152 (25.3)	47 (27.6)	105 (24.4)	
Two-vessel	221 (36.8)	64 (37.6)	157 (36.5)	
Three-vessel	215 (35.8)	57 (33.5)	158 (36.7)	
Proximal LAD stenosis ≥75%	389 (64.8)	110 (64.7)	279 (64.9)	0.967
Left main stenosis (≥50%)	14 (2.3)	5 (2.9)	9 (2.1)	0.553
Current CCS angina class, no. (%)				0.546
No angina	236 (39.3)	72 (42.4)	164 (38.1)	
I	94 (15.6)	29 (17.1)	65 (15.1)	
II	253 (42.1)	63 (37.1)	190 (44.1)	
III	14 (2.3)	5 (2.9)	9 (2.1)	
IV	4 (0.7))	1 (0.6)	3 (0.7)	

Highest NYHA functional class within 3 months, no. (%)				0.321
I	27 (4.5)	6 (3.5)	21 (4.9)	
II	212 (35.3)	52 (30.6)	160 (37.1)	
III	275 (45.8)	87 (51.2)	188 (43.6)	
IV	87 (14.5)	25 (14.7)	62 (14.4)	
Medications at baseline, no. (%)				
Beta blocker	534 (88.9)	141 (82.9)	393 (91.2)	0.004
ACE inhibitor	514 (85.5)	131 (77.1)	383 (88.9)	<0.001
Angiotensin receptor blocker	46 (7.7)	16 (9.4)	30 (7.0)	0.309
ACE inhibitor or ARB	554 (92.2)	147 (86.5)	407 94.4)	0.001
Statin	508 (84.5)	145 (85.3)	363 (84.2)	0.744
Aspirin	513 (85.4)	140 (82.4)	373 (86.5)	0.191
Digoxin	109 (18.1)	31 (18.2)	78 (18.1)	0.968
Blood pressure, mean ± SD				
Systolic (mmHg)	119.8 ± 17.3	121.0 ± 16.3	119.3 ± 17.7	0.149
Diastolic (mmHg)	74.7 ± 10.7	75.1 ± 9.7	74.5 ± 11.0	0.492
Heart rate, mean ± SD	73.3 ± 12.9	72.5 ± 13.3	73.7 ± 12.7	0.228
LV ejection fraction, mean ± SD	0.267 ± 0.086	0.256 ± 0.077	0.271 ± 0.089	0.106
LVEDVI (ml/m2), mean ± SD	122.8 ± 41.9	126.1 ± 43.9	121.6 ± 41.7	0.289
LVESVI (ml/m2), mean ± SD	91.7 ± 38.9	95.5 ± 40.9	90.3 ± 38.0	0.133
Hemoglobin (g/dL), mean ± SD	13.9 ± 1.7	13.8 ± 1.7	13.9 ± 1.7	0.347
Creatinine (mg/dL), mean ± SD	1.2 ± 0.7	1.2 ± 0.4	1.2 ± 0.8	0.409
BUN (mg/dL), mean ± SD	29.2 ± 19.7	32.2 ± 21.4	27.8 ± 18.7	0.047

*Includes 362 patients studied after day of randomization and 69 patients studied on day of randomization

ACE = angiotensin converting enzyme; ARB = angiotensin receptor blocker; BUN = blood urea nitrogen; CABG = coronary artery bypass graft surgery; CAD = coronary artery disease; CCS = Canadian Cardiac Society; EDVI = end-diastolic volume index; ESVI = end-systolic volume index; ICD = implantable cardioverter defibrillator; LV= left ventricular; NYHA = New York Heart Association; RAR = risk at randomization

Table S4.
Baseline characteristics of patients with viability tests assigned to CABG vs. medical therapy

Characteristic	All patients with viability testing (n=601)	Patients randomized to MED (n=303)	Patients randomized To CABG (n=298)	P value
Received CABG treatment (%)	310 (51.6)	31 (10.2)	279 (93.6)	<0.001
Patients with viable myocardium (%)	487 (81.0)	243 (80.2)	244 (81.9)	0.599
Age, mean ± SD	60.7 ± 9.4	60.3 ± 9.5	61.2 ±9.2	0.182
Male, no. (%)	521 (86.7)	260 (85.8)	261 (87.6)	0.522
Race, no. (%)				0.720
White	496 (82.5)	253 (83.5)	243 (81.5)	
Black	18 (3.0)	7 (2.3)	11 (3.7)	
Asian	29 (4.8)	15 (5.0)	14 (4.7)	
Other	54 (9.0)	27(8.9)	27 (9.1)	
Multi-racial	4 (0.7)	1 (0.3)	3 (1.0)	
Prior myocardial infarction, no. (%)	481 (80.0)	246 (81.2)	235 (78.9)	0.475
Diabetes, no. (%)	224 (37.3)	113 (37.3)	111 (37.2)	0.991
Stroke, no. (%)	53 (8.8)	26 (8.6)	27 (9.1)	0.835
Hypertension, no. (%)	363 (60.4)	182 (60.1)	181 (60.7)	0.866
Hyperlipidemia, no. (%)	403 (67.3)	202 (66.9)	201 (67.7)	0.837
Current smoker, no. (%)	126 (21.0)	65 (21.5)	61 (20.5)	0.767
Chronic renal insufficiency, no. (%)	43 (7.2)	17 (5.6)	26 (8.8)	0.136
Atrial flutter/fibrillation, no. (%)	90 (15.0)	46 (15.2)	44 (14.8)	0.886
Peripheral vascular disease,no. (%)	91 (15.1)	52 (17.2)	39 (13.1)	0.163
RAR score, mean ± SD	12.5 ± 8.8	12.2 ± 8.6	12.7 ± 9.0	0.554
Previous CABG, no. (%)	16 (2.7)	6 (2.0)	10 (3.4)	0.295
Previous PCI, no. (%)	104 (17.3)	46 (15.2)	58 (19.5)	0.165
Previous ICD, no. (%)	16 (2.7)	7 (2.3)	9 (3.0)	0.589
CAD distribution, no. (%)				
No. of diseased vessels ≥75%				0.515
None	12 (2.0)	8 (2.6)	4 (1.3)	
One-vessel	152 (25.3)	79 (26.1)	73 (24.6)	
Two-vessel	221 (36.8)	105 (34.7)	116 (39.1)	
Three-vessel	215 (35.8)	111 (36.6)	104 (35.0)	
Proximal LAD stenosis ≥75%	389 (64.8)	199 (65.7)	190 (64.0)	0.662
Left main stenosis (≥50%)	14 (2.3)	6 (2.0)	8 (2.7)	0.563
Current CCS angina class, no. (%)				0.132
No angina	236 (39.3)	119 (39.3)	117 (39.3)	
I	94 (15.6)	53 (17.5)	41 (13.8)	
II	253 (42.1)	127 (41.9)	126 (42.3)	
III	14 (2.3)	3 (1.0)	11 (3.7)	
IV	4 (0.7))	1 (0.3)	3 (1.0)	

Highest NYHA functional class within 3 months, no. (%)				0.938
I	27 (4.5)	15 (5.0	12 (4.0)	
II	212 (35.3)	108 (35.6)	104 (34.9)	
III	275 (45.8)	136 (44.9)	139 (46.6)	
IV	87 (14.5)	44 (14.5)	43 (14.4)	
Medications at baseline, no. (%)				
Beta blocker	534 (88.9)	273 (90.1)	261 (87.6)	0.327
ACE inhibitor	514 (85.5)	256 (84.5)	258 (86.6)	0.467
Angiotensin receptor blocker	46 (7.7)	23 (7.6)	23 (7.7)	0.953
ACE inhibitor or ARB	554 (92.2)	276 (91.1)	278 (93.3)	0.315
Statin	508 (84.5)	268 (88.4)	240 (80.5)	0.007
Aspirin	513 (85.4)	265 (87.5)	248 (83.2)	0.142
Digoxin	109 (18.1)	55 (18.2)	54 (18.1)	0.992
Blood pressure, mean ± SD				
Systolic (mmHg)	119.8 ± 17.3	119 ± 17.0	120.5 ± 17.7	0.682
Diastolic (mmHg)	74.7 ± 10.7	74.8 ± 10.8	74.6 ± 10.5	0.516
Heart rate, mean ± SD	73.3 ± 12.9	72.8 ± 11.8	73.8 ± 13.9	0.634
LV ejection fraction, mean ± SD	0.267 ± 0.086	0.270 ± 0.087	0.263 ± 0.085	0.654
LVEDVI (ml/m2), mean ± SD	122.8 ± 41.9	125.1 ± 43.4	120.6 ± 40.3	0.202
LVESVI (ml/m2), mean ± SD	91.7 ± 38.9	92.9 ± 40.3	90.6 ± 37.4	0.503
Hemoglobin (g/dL), mean ± SD	13.9 ± 1.7	13.9 ± 1.7	13.9 ±1.7	0.813
Creatinine (mg/dL), mean ± SD	1.2 ± 0.7	1.1 ± 0.4	1.2 ± 0.9	0.268
BUN (mg/dL), mean ± SD	29.2 ± 19.7	28.7 ± 20.4	29.7 ± 19.0	0.455
Viability testing, no. (%)				
SPECT	471 (78.4)	231 (76.2)	240 (80.5)	0.201
DE	280 (46.6)	150 (49.5)	130 (43/6)	0.149
SPECT + DE	150 (25.0)	78 (25.7)	72 (24.2)	0.654

ACE = angiotensin converting enzyme; ARB = angiotensin receptor blocker; BUN = blood urea nitrogen; CABG = coronary artery bypass graft surgery; CAD = coronary artery disease; CCS = Canadian Cardiac Society; DE = dobutamine echocardiography; EDVI = end-diastolic volume index; ESVI = end-systolic volume index; ICD = implantable cardioverter defibrillator; LV= left ventricular; NYHA = New York Heart Association; RAR = risk at randomization; SPECT = single photon emission computed tomography

Table S5. Baseline characteristics of patients with and without evidence of viable myocardium

Characteristic	All patients with viability testing (n=601)	Patients with myocardial viability* (n=487)	Patients without myocardial viability* (n=114)	P value
Age, mean ± SD	60.7 ± 9.4	60.7 ± 9.5	60.8 ± 8.8	0.891
Male, no. (%)	521 (86.7)	416 (85.4)	105 (92.1)	0.059
Race, no. (%)				0.209
White	496 (82.5)	393 (80.7)	103 (90.4)	
Black	18 (3.0)	17 (3.5)	1 (0.9)	
Asian	29 (4.8)	26 (5.3)	3 (2.6)	
Other	54 (9.0)	47 (9.7)	7 (6.1)	
Multi-racial	4 (0.7)	4 (0.8)	0 (0.0)	
Prior myocardial infarction, no. (%)	481 (80.0)	373 (76.6)	108 (94.7)	<0.001
Diabetes, no. (%)	224 (37.3)	198 (40.7)	26 (22.8)	<0.001
Stroke, no. (%)	53 (8.8)	42 (8.6)	11 (9.6)	0.728
Hypertension, no. (%)	363 (60.4)	312 (64.1)	50 (44.7)	<0.001
Hyperlipidemia, no. (%)	403 (67.3)	326 (67.1)	77 (68.1)	0.828
Current smoker, no. (%)	126 (21.0)	108 (22.2)	18 (15.8)	0.131
Chronic renal insufficiency, no. (%)	43 (7.2)	33 (6.8)	10 (8.8)	0.460
Atrial flutter/fibrillation, no. (%)	90 (15.0)	74 (15.2)	16 (14.0)	0.755
Peripheral vascular disease,no. (%)	91 (15.1)	75 (15.4)	16 (14.0)	0.714
RAR score, mean ± SD	12.5 ± 8.8	12.4 ± 8.7	12.9 ± 9.3	0.753
Previous CABG, no. (%)	16 (2.7)	12 (2.5)	4 (3.5)	0.520
Bypass graft status, no. (%)				
≥1 stenosed or occluded	15 (93.8)	11 (91.7)	4 (100)	1.000
≥1 occluded	14 (87.5)	10 (83.3)	4 (100)	1.000
Previous PCI, no. (%)	104 (17.3)	77 (15.8)	27 (23.7)	0.045
Previous ICD, no. (%)	16 (2.7)	10 (2.1)	6 (5.3)	0.096
CAD distribution, no. (%)				
No. of diseased vessels ≥75%				0.957
None	12 (2.0)	9 (1.9)	3 (2.6)	
One-vessel	152 (25.3)	124 (25.5)	28 (24.6)	
Two-vessel	221 (36.8)	179 (36.8)	42 (36.8)	
Three-vessel	215 (35.8)	174 (35.8)	41 (36.0)	
Proximal LAD stenosis ≥75%	389 (64.8)	309 (63.6)	80 (70.2)	0.184
Left main stenosis (≥50%)	14 (2.3)	12 (2.5)	2 (1.8)	1.000
Current CCS angina class, no. (%)				0.061
No angina	236 (39.3)	202 (41.5)	34 (29.8)	
I	94 (15.6)	68 (14.0)	26 (22.8)	
II	253 (42.1)	203 (41.7)	50 (43.9)	
III	14 (2.3)	11 (2.3)	3 (2.6)	
IV	4 (0.7))	3 (0.6)	1 (0.9)	
Highest NYHA functional class within 3 months, no. (%)				0.055
I	27 (4.5)	24 (4.9)	3 (2.6)	
II	212 (35.3)	182 (37.4)	30 (26.3)	
III	275 (45.8)	211 (43.3)	64 (56.1)	
IV	87 (14.5)	70 (14.4)	17 (14.9)	

Medications at baseline, no. (%)				
Beta blocker	534 (88.9)	437 (89.7)	96 (85.0)	0.156
ACE inhibitor	514 (85.5)	412 (84.6)	102 (89.5)	0.183
Angiotensin receptor blocker	46 (7.7)	40 (8.2)	6 (5.3)	0.286
ACE inhibitor or ARB	554 (92.2)	446 (91.6)	108 (94.7)	0.259
Statin	508 (84.5)	405 (83.2)	103 (90.4)	0.056
Aspirin	513 (85.4)	414 (85.0)	99 (86.8)	0.618
Digoxin	109 (18.1)	80 (16.4)	29 (25.4)	0.025
Blood pressure, mean ± SD				
Systolic (mmHg)	119.8 ± 17.3	121.1 ± 17.7	114.4 ± 14.3	<0.001
Diastolic (mmHg)	74.7 ± 10.7	74.9 ± 10.9	73.7 ± 9.3	0.447
Heart rate, mean ± SD	73.3 ± 12.9	73.3 ± 12.4	73.5 ± 14.7	0.839
LV ejection fraction, mean ± SD	0.267 ± 0.086	0.275 ± 0.083	0.229 ± 0.088	<0.001
LVEDVI (ml/m2), mean ± SD	122.8 ± 41.9	116.9 ± 36.5	146.5 ± 52.6	<0.001
LVESVI (ml/m2), mean ± SD	91.7 ± 38.9	85.9 ± 33.2	116.3 ± 50.2	<0.001
Hemoglobin (g/dL), mean ± SD	13.9 ± 1.7	13.9 ± 1.7	14.1 ± 1.6	0.426
Creatinine (mg/dL), mean ± SD	1.2 ± 0.7	1.2 ± 0.8	1.2 ± 0.4	0.123
BUN (mg/dL), mean ± SD	29.2 ± 19.7	29.5 ± 20.0	27.3 ± 18.0	0.485

ACE = angiotensin converting enzyme; ARB = angiotensin receptor blocker; BUN = blood urea nitrogen; CABG = coronary artery bypass graft surgery; CAD = coronary artery disease; CCS = Canadian Cardiac Society; EDVI = end-diastolic volume index; ESVI = end-systolic volume index; ICD = implantable cardioverter defibrillator; LV= left ventricular; NYHA = New York Heart Association; RAR = risk at randomization

Table S6. Baseline Characteristics of Patients with Viability Tests Assigned to CABG versus Medical Therapy

Characteristic	All patients with viability testing (n=601)	Patients with myocardial viability (n=487)			Patients without myocardial viability (n=114)		
		MED (n=243)	CABG (n=244)	P value	MED (n=60)	CABG (n=54)	P value
Age, mean ± SD	60.7 ± 9.4	60.0 ± 9.7	61.5 ± 9.2	0.054	61.6 ± 8.5	60.0 ± 9.2	0.341
Male, no. (%)	521 (86.7)	205 (84.4)	211 (86.5)	0.509	55 (91.7)	50 (92.6)	1.000
Race, no. (%)				0.787			0.406
White	496 (82.5)	197 (81.1)	196 (80.3)		56 (93.3)	47 (87.0)	
Black	18 (3.0)	7 (2.9)	10 (4.1)		0 (0.0)	1 (1.9)	
Asian	29 (4.8)	13 (5.3)	13 (5.3)		2 (3.3)	1 (1.9)	
Other	54 (9.0)	25 (10.3)	22 (9.0)		2 (3.3)	5 (9.3)	
Multi-racial	4 (0.7)	1 (0.4)	3 (1.2)		0. (0.0)	0 (0.0)	
Prior myocardial infarction, no. (%)	481 (80.0)	190 (78.2)	183 (75.0)	0.406	56 (93.3)	52 (96.3)	0.682
Diabetes, no. (%)	224 (37.3)	103 (42.4)	95 (38.9)	0.438	10 (16.7)	16 (29.6)	0.100
Stroke, no. (%)	53 (8.8)	18 (7.4)	24 (9.8)	0.340	8 (13.3)	3 (5.6)	0.160
Hypertension, no. (%)	363 (60.4)	155 (63.8)	157 (64.3)	0.898	27 (45.0)	24 (44.4)	0.952
Hyperlipidemia, no. (%)	403 (67.3)	162 (66.9)	164 (67.2)	0.949	40 (66.17)	37 (68.5)	0.720
Current smoker, no. (%)	126 (21.0)	55 (22.6)	53 (21.7)	0.808	10 (16.7)	8 (14.8)	0.787
Chronic renal insufficiency, no. (%)	43 (7.2)	11 (4.5)	22 (9.1)	0.047	6(10.0)	4 (7.4)	0.746
Atrial flutter/fibrillation, no. (%)	90 (15.0)	37 (15.2)	37 (15.2)	0.985	9 (15.0)	7 (13.0)	0.755
Peripheral vascular disease,no. (%)	91 (15.1)	40 (16.5)	35 (14.3)	0.518	12 (20.0)	4 (7.4)	0.053
RAR score, mean ± SD	12.5 ± 8.8	11.9 ± 8.4	12.8 ± 9.0	0.283	13.7 ± 9.8	12.0 ± 8.8	0.368
Previous CABG, no. (%)	16 (2.7)	12 (2.5)	4 (1.6)	0.245	2 (3.3)	2 (3.7)	1.000
Previous PCI, no. (%)	104 (17.3)	31 (12.8)	46 (18.9)	0.065	15 (25.0)	12 (22.2)	0.728
Previous ICD, no. (%)	16 (2.7)	4 (1.6)	6 (2.5)	0.751	3 (5.0)	3 (5.6)	1.000
Current CCS angina class, no. (%)				0.604			0.031
No angina	236 (39.3)	101 (41.6)	101 (41.4)		18 (30.0)	16 (29.6)	
I	94 (15.6)	34 (14.0)	34 (13.9)		19 (31.7)	7 (13.0)	
II	253 (42.1)	104 (42.8)	99 (40.6)		23 (398.3)	27 (50.0)	
III	14 (2.3)	3 (1.2)	8 (3.3)		0 (0.0)	3 (5.6)	
IV	4 (0.7))	1 (0.4)	2 (0.8)		0 (0.0)	1 (1.9)	
Highest NYHA functional class within 3 months, no. (%)				0.508			0.254
I	27 (4.5)	15 (6.2)	9 (3.7)		0 (0.0)	3 (5.6)	
II	212 (35.3)	94 (38.7)	88 (36.1)		14 (23.3)	16 (29.6)	
III	275 (45.8)	100 (41.2)	111 (45.5)		36 (60.0)	28 (51.9)	
IV	87 (14.5)	34 (14.0)	36 (14.8)		10 (16.7)	7 (13.0)	

Blood pressure, mean ± SD							
Systolic (mmHg)	119.8 ± 17.3	120.5 ± 17.1	121.6 ± 18.4	0.738	113.6 ± 15.6	115.3 ± 12.9	0.852
Diastolic (mmHg)	74.7 ± 10.7	75.1 ± 11.0	74.6 ± 10.9	0.401	73.3 ± 10.1	74,2 ± 8.4	0.759
Heart rate, mean ± SD	73.3 ± 12.9	73.1± 12.3	73.5 ± 12.5	0.764	71.9 ± 9.6	75.4 ± 18.8	0.657
Hemoglobin (g/dL), mean ± SD	13.9 ± 1.7	13.9 ± 1.7	13.8 ± 1.7	0.720	13.9 ± 1.6	14.3 ± 1.6	0.163
Creatinine (mg/dL), mean ± SD	1.2 ± 0.7	1.1 ± 0.4	1.2 ± 1.0	0.263	1.2 ± 0.4	1.1 ± 0.3	0.656
BUN (mg/dL), mean ± SD	29.2 ± 19.7	29.9 ± 20.8	29.1 ± 19.2	0.693	23.2 ± 17.2	33.9 ± 17.6	0.010
Medications at baseline, no. (%)							
Beta blocker	534 (88.9)	221 (90.9)	216 (88.5)	0.379	52 (86.7)	45 (83.3)	0.618
ACE inhibitor	514 (85.5)	202 (83.1)	210 (86.1)	0.369	54 (90.0)	48 (88.9)	0.847
Angiotensin receptor blocker	46 (7.7)	20 (8.2)	20 (8.2)	0.989	3 (5.0)	3 (5.6)	1.000
ACE inhibitor or ARB	554 (92.2)	219 (90.1)	227 (93.0)	0.248	57 (95.0)	51 (94.4)	1.000
Statin	508 (84.5)	212 (87.2)	193 (79.1)	0.016	56 (93.3)	47 (87.0)	0.256
Aspirin	513 (85.4)	209 (86.0)	205 (84.0)	0.538	56 (93.5)	43 (79.6)	0.031
Digoxin	109 (18.1)	40 (16.5)	40 (16.4)	0.984	15 (25.0)	14 (25.9)	0.910
CAD distribution, no. (%)							
No. of diseased vessels ≥75%				0.789			0.447
None	12 (2.0)	6 (2.5)	3 (1.2)		2 (3.3)	1 (1.9)	
One-vessel	152 (25.3)	62 (25.5)	62 (25.5)		17 (28.3)	11 (20.4)	
Two-vessel	221 (36.8)	87 (35.8)	92 (37.9)		18 (30.0)	24 (44.4)	
Three-vessel	215 (35.8)	88 (36.2)	86 (35.4)		23 (38.3)	18 (33.3)	
Proximal LAD stenosis ≥75%	389 (64.8)	157 (64.6)	152 (62.6)	0.637	42 (70.0)	38 (70.4)	0.966
Left main stenosis (≥50%)	14 (2.3)	6 (2.5)	6 (2.5)	1.000	0 (0.0)	2 (3.7)	0.222
LV ejection fraction, mean ± SD	0.267 ± 0.086	0.281 ± 0.084	0.270 ± 0.082	0.295	0.226 ± 0.085	0.233 ± 0.091	0.503
LVEDVI (ml/m2), mean ± SD	122.8 ± 41.9	117.8 ± 37.9	116 ± 35.1	0.628	152.3 ± 51.3	140.0 ± 53.8	0.186
LVESVI (ml/m2), mean ± SD	91.7 ± 38.9	85.8 ± 34.3	86.0 ± 32.1	0.974	120.8 ± 49.6	111.2 ± 50.8	0.253
Viability testing, no. (%)							
SPECT	471 (78.4)	182 (74.9)	197 (80.1)	0.121	49 (81.7)	43 (79.6)	0.783
DE	280 (46.6)	121 (49.8)	108 (44.3)	0.221	29 (48.3)	22 (40.7)	0.416
SPECT + DE	150 (25.0)	60 (24.7)	61 (25.0)	0.937	18 (30.0)	11 (20.4)	0.238
Received CABG, no. (%)	310 (51.6)	28 (11.5)	230 (94.3)	<0.001	3 (5.0)	49 (90.7)	<0.001

ACE = angiotensin converting enzyme; ARB = angiotensin receptor blocker; BUN = blood urea nitrogen; CABG = coronary artery bypass graft surgery; CAD = coronary artery disease; CCS = Canadian Cardiac Society; DE = dobutamine echocardiography; EDVI = end-diastolic volume index; ESVI = end-systolic volume index; ICD = implantable cardioverter defibrillator; LV= left ventricular; MED = medical therapy; NYHA = New York Heart Association; SPECT = single photon emission computed tomography

Table S7. Baseline Characteristics Significantly Associated with Mortality (From Univariate Cox Model Analyses)

Variable	Mortality	
	Chi-square*	p value
RAR score	33.26	<0.001
LV ejection fraction	24.80	<0.001
LV end-diastolic volume index	35.36	<0.001
LV end-systolic volume index	33.90	<0.001
Myocardial viability	8.54	0.003

LV = left ventricular; RAR = risk at randomization

Table S8. Association of viability with mortality by Cox model analysis

Variable	No.	Univariate analysis		Multivariable analysis*	
		Chi-square	p value	Chi-square	p value
SPECT and/or dobutamine echo	601	8.54	0.003	1.57	0.210
SPECT alone	471	7.35	0.007	0.58	0.443
Dobutamine echo alone	280	1.18	0.277	0.42	0.518

*Note: The Chi-square and p-value from multivariable analyses are obtained from Cox model adjusting for treatment (as randomized), stratum, age, gender, race, heart failure class at baseline, history of myocardial infarction, previous revascularization, baseline ejection fraction, number of diseased vessels, chronic renal insufficiency, mitral regurgitation, history of stroke, and history of atrial flutter/fibrillation.
SPECT=single photon emission computed tomography

Table S9. Cox Model Tests for Interaction Between Viability and Treatment with Respect to Specified Outcomes

Endpoint	Treatment	Total patients in the model	Events	Chi-Square	P-value
Mortality	As Randomized	601	236	0.3981	0.528
	As Treated	601	236	0.0023	0.962
Mortality or Cardiovascular Hospitalization	As Randomized	601	422	0.7380	0.390
	As Treated	601	422	0.0010	0.975
Cardiovascular Mortality	As Randomized	601	187	0.1518	0.697
	As Treated	601	187	1.2647	0.261