

## Supplementary Appendix

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

Supplement to: Jones RH, Velazquez EJ, Michler RE, et al. Coronary bypass surgery with or without surgical ventricular reconstruction. *N Engl J Med* 2009;360:1705-17. DOI: 10.1056/NEJMoa0900559.

## **Coronary Bypass Surgery with or without Surgical Ventricular Reconstruction**

### **Online Supplementary Appendix**

Robert H. Jones, M.D., Eric J. Velazquez, M.D., Robert E. Michler, M.D., George Sopko, M.D., Jae K. Oh, M.D., Christopher M. O'Connor, M.D., James A. Hill, M.D., Lorenzo Menicanti, M.D., Zygmunt Sadowski, M.D., Patrice Desvigne-Nickens, M.D., Jean-Lucien Rouleau, M.D., Kerry L. Lee, Ph.D.  
for the STICH Hypothesis 2 Investigators

Division of Cardiothoracic Surgery/Department of Surgery, Duke Clinical Research Institute, Duke University Medical Center, Durham, North Carolina (RHJ);  
Division of Cardiovascular Medicine/Department of Medicine, Duke Clinical Research Institute, Duke University Medical Center, Durham, North Carolina (EJV, CMO);  
Department of Cardiothoracic Surgery and Department of Surgery, Montefiore Medical Center/Albert Einstein College of Medicine, Bronx, New York (REM); Division of Cardiovascular Diseases, National Heart, Lung, and Blood Institute, National Institutes of Health, Bethesda, Maryland (GS, PD-N); Division of Cardiovascular Diseases, Department of Internal Medicine, Mayo Clinic, Rochester, Minnesota (JKO); Division of Cardiovascular Medicine, University of Florida College of Medicine, Gainesville, Florida (JAH); Department of Cardiac Surgery, San Donato Hospital, Milan, Italy (LM); National Institute of Cardiology, Warsaw, Poland (ZS); Institut de Cardiologie de Montreal, University of Montreal, Montreal, Canada (JLR); Department of Biostatistics and Bioinformatics, Duke Clinical Research Institute, Duke University Medical Center, Durham, North Carolina (KLL)

#### Address for Correspondence:

Robert H. Jones, M.D.  
Mary and Deryl Hart Professor of Surgery  
P. O. Box 2986, Duke University Medical Center  
Durham, NC 27710  
Telephone: 919-668-8357  
Fax: 919-684-5700  
Email: [jones060@mc.duke.edu](mailto:jones060@mc.duke.edu)

## Hypothesis 2 Investigators and Trial Committees

The following institutions and principal investigators (PI), lead surgeons (LS), lead cardiologists (LC), and study coordinators (SC) participated in STICH Hypothesis 2 enrollment: **Investigators** (listed in descending order of the number of randomized patients): Slaski Ośrodek Kardiologii, Katowice, Poland: A. Bochenek-PI, M. Krejca-LS, M. Trusz-Gluza-LC, K. Wita-SC; Silesian Medical Academy, Zabrze, Poland: M. Zembala-PI, R. Przybylski-LS, T. Kukulski-SC; 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, J. Kot-SC; Toronto General Hospital, Toronto, Canada: V. Rao-PI, M. Iwanochko-LC, J. Renton-SC, S. Hemeon-SC; Medical University of Gdansk, Gdansk, Poland: J. Rogowski-PI, A. Rynkiewicz-LC, P. Betlejewski-SC; Ohio State University Medical Center, Columbus, USA: B. Sun-PI, J. Crestanello-LS, P. Binkley-LC, J. Chang-SC; Ospedali Riuniti di Bergamo, Bergamo, Italy: P. Ferrazzi-PI, A. Gavazzi-LC, M. Senni-SC; John Paul II Hospital, Krakow, Poland: J. Sadowski-PI, B. Kapelak-LS, D. Sobczyk-LC, K. Wrobel-SC; Institute for Clinical and Experimental Medicine, Prague, Czech Republic: J. Pirk-PI, R. Jandova-SC; Duke University Medical Center, Durham, USA: E. Velazquez-PI, P. Smith-LS, C. Milano-LS, P. Adams-SC; San Donato Hospital, Milan, Italy: L. Menicanti-PI, M. Di Donato-LC, S. Castelvechio-SC; Laval Hospital, Sainte Foy, Canada: F. Dagenais-PI, G. Dussault-SC; University of North Carolina Hospitals, Chapel Hill, USA: C. Dupree-PI, B. Sheridan-LS, C. Schuler-SC; St. Vincent's Hospital Melbourne, Melbourne, Australia: M. Yii-PI, D. Prior-LC, J. Mack-SC; Montreal Heart Institute, Montreal, Canada: N. Racine-PI, D. Bouchard-LS, A. Ducharme-LC, J. Lavoignat-SC; University of Vienna Allgemeines Krankenhaus, Vienna, Austria: G. Maurer-PI, M. Grimm-LS, I. Lang-LC, C. Adlbrecht-SC; National Institute of Cardiology, Warsaw, Poland: Z. Religa-PI, A. Biederman-LS, H. Szwed-LC, Z. Sadowski-SC; Capital Health Queen Elizabeth II Health Sciences Centre, Halifax, Canada: M. Rajda-PI, I. Ali-LS, J. Howlett-LC, M. MacFarlane-SC; University of Freiburg, Freiburg, Germany: M. Siepe-PI, F. Beyersdorf-LS, C. Cuerten-SC; Katedra I Klinika Kardiologii, Szczecin, Poland: S. Wiechowski-PI, K. Mokrzycki-SC; Shands Hospital at the University of Florida, Gainesville, USA: J. Hill-PI, T. Beaver-LS, D. Olitsky-SC; Vancouver General Hospital, Vancouver, Canada: V. Bernstein-PI, M. Janusz-LS, V. O'Neill-SC; Baylor University Medical Center, Dallas, USA: P. Grayburn-PI, R. Hebel-LS, B. Hamman-LS, S. Aston-SC; Dedinje Cardiovascular Institute, Belgrade, Serbia: S. Gradinac-PI, M. Vukovic-LC, L. Djokovic-SC; Kaunas Medical University Clinics, Kaunas, Lithuania: R. Benetis-PI, L. Jankauskiene-SC; Martin Luther University, Halle, Germany: I. Friedrich-PI, M. Buerke-LC, A. Paraforos-SC; Poliambulanza Hospital, Brescia, Italy: E. Quaini-PI, M. Cirillo-SC; National Heart Centre Singapore, Singapore: L. Chua-PI, C. Lim-LS, B. Kwok-LC, S. Kong-SC; Hesperia Hospital, Modena, Italy: G. Stefanelli-PI, C. Labia-SC; Sahlgrenska University Hospital, Goteborg, Sweden: C. Bergh-PI, C. Gustafsson-SC; Mayo Clinic, Rochester, USA: R. Daly-PI, R. Rodeheffer-LC, S. Nelson-SC; Foothills Medical Centre, Calgary, Canada: A. Maitland-PI, D. Isaac-LC, M. Holland-SC; S. Giovanni Di Dio Ruggi D'Aragona Hospital, Salerno, Italy: G. Di Benedetto-PI, T. Attisano-SC; Universitat Schleswig-Holstein, Lubeck, Germany: H. Sievers-PI, H. Schunkert-LC, U. Stierle-SC; Ottawa Heart Institute, Ottawa, Canada: H. Haddad-PI, P. Hendry-LS, J. Donaldson-SC; Boston V.A. Healthcare System, West Roxbury, USA: V. Birjiniuk-PI, M. Harrington-SC; Chiang Mai University Hospital, Chiang Mai, Thailand: W. Nawarawong-PI, S. Woragidpunpol-LS, S. Kuanprasert-LC, W. Mekara-SC; Saint Mary's Duluth Clinic Health System, Duluth, USA: S. Konda-PI, C. Neva-SC; Mission Hospital, Inc., Asheville, USA: W. Hathaway-PI, M. Groh-LS, J. Blakely-SC; Hamilton General Hospital, Hamilton, Canada: A. Lamy-PI, C. Demers-LC, T. Rizzo-SC; University of Texas Southwestern Medical Center, Dallas, USA:

M. Drazner-PI, J. DiMaio-LS, J. Joy-SC; *Na Homolce Hospital, Prague, Czech Republic*: J. Benedik-PI, K. Marketa-SC; *Ospedale Maggiore, Parma, Italy*: C. Beghi-PI, M. De Blasi-SC; *Hopital Notre-Dame du CHUM, Montreal, Canada*: J. Helou-PI, S. Dallaire-SC; *University of Virginia Health System, Charlottesville, USA*: I. Kron-PI, J. Kern-LS, J. Bergin-LC, J. Phillips-SC; *University of Washington Medical Center, Seattle, USA*: G. Aldea-PI, E. Verrier-LS, L. Harrison-SC; *Instituto Dante Pazzanese de Cardiologia, Sao Paulo, Brazil*: L. Piegas-PI, P. Paulista -LS, P. Farsky-LC, C. Veiga-Kantorowitz-SC; *Boston Medical Center, Boston, USA*: G. Philippides-PI, R. Shemin-LS, J. Thompson-SC; *Auckland City Hospital, Auckland, New Zealand*: H. White-PI, P. Alison-LS, R. Stewart-LC, T. Clapham-SC; *Sentara Norfolk General Hospital, Norfolk, USA*: J. Rich-PI, J. Herre-LC, L. Pine-SC; *Fundacao Universitaria de Cardiologia, Porto Alegre, Brazil*: R. Kalil-PI, I. Nesralla-LS, M. Santos-LC, M. Pereira de Moraes-SC; *Montefiore Medical Center/Albert Einstein College of Medicine, Bronx, USA*: R. Michler-PI, R. Swayze-SC; *University Hospital-London Health Sciences Center, London, Canada*: M. Arnold-PI, N. McKenzie-LS, J. Smith-SC; *Instituto do Coração (InCor) - HC/FMUSP, Sao Paulo, Brazil*: J. Nicolau-PI, S. Oliveira-LS, N. Stolf-LS, M. Ferraz-SC; *Casa De Galicia, Montevideo, Uruguay*: J. Filgueira-PI, C. Battle-SC; *Hospital de Cardiologia de Laranjeiras, Rio de Janeiro, Brazil*: A. Rocha-PI, A. Gurgel Camara-SC; *Montreal General Hospital, Montreal, Canada*: T. Huynh-PI, R. Cecere-LS, S. Finkenbine-SC, B. St-Jacques-SC; *Royal Darwin Hospital, Darwin, Australia*: M. Ilton-PI, Johns Hopkins Hospital, Baltimore, USA: I. Wittstein-PI, J. Conte-LS, E. Breton-SC; *Washington Hospital Center, Washington, DC, USA*: J. Panza-PI, S. Boyce-LS, M. McNulty-SC; *Los Angeles County and University of Southern California Medical Center, Los Angeles, USA*: V. Starnes-PI, B. Lopez-SC; *Allegheny General Hospital, Pittsburgh, USA*: R. Biederman-PI, J. Magovern-LS, D. Dean-LS, S. Grant-SC; *Wake Forest University Health Services, Winston-Salem, USA*: J. Hammon-PI, G. Wells-LC, Flinders Medical Centre, Adelaide, Australia: C. De Pasquale-PI, J. Knight-LS, H. Healy-SC; *Hospital de Base da Faculdade de Medicina de Sao Jose Rio Preto, Sao Paulo, Brazil*: L. Maia-PI, A. Souza-SC; *Heartcare Mid West, Peoria, USA*: R. McRae-PI, M. Pierson-SC; *Rikshospitalet HF, Oslo, Norway*: L. Gullestad-PI, G. Sorensen-SC; *Portland V.A. Medical Center, Portland, USA*: E. Murphy-PI, P. Ravichandran-LS, K. Avalos-SC; *Queen Elizabeth Hospital, Woodville, Australia*: J. Horowitz-PI, E. Owen-SC; *Columbia University Medical Center, New York, USA*: D. Ascheim-PI, Y. Naka-LS, M. Yushak-SC; *Humanitas-Gavazzeni, Bergamo, Italy*: P. Gerometta-PI, V. Arena-LS, E. Borghini-SC; *Lund University Hospital, Lund, Sweden*: P. Johnsson-PI, B. Ekmehag-LC, K. Engels-SC; *Westchester Medical Center-New York Medical College, Valhalla, USA*: W. Rosenblum-PI, R. Swayze-SC; *Albert Einstein Medical Center, Philadelphia, USA*: A. Amanullah-PI, *Instytut Kardiologii AM, Lodz, Poland*: M. Krzeminska-Pakula-PI, J. Drozd-SC; *Royal Perth Hospital, Perth, Australia*: R. Larbalestier-PI, X. Wang-SC; *National Medical Center, Budapest, Hungary*: C. Busmann-SC; *George Gottsegen National Institute of Cardiology, Budapest, Hungary*: F. Horkay-PI, L. Szekely-LS, M. Keltai-LC, *German Heart Institute Berlin-DHQB, Berlin, Germany*: R. Hetzer-PI, C. Knosalla-LS, T. Nienkarken-SC; *Policlinico Tor Vergata of Rome, Rome, Italy*: L. Chiariello-PI, P. Nardi-SC; *Bangkok Heart Hospital, Bangkok, Thailand*: K. Arom-PI, P. Ruengsakulrach-SC; *St. Vincent's Hospital Sydney, Sydney, Australia*: C. Hayward-PI, P. Jansz-LS, S. Stuart-SC; *Dokuz Eylul University, Balçova, Turkey*: O. Oto-PI, O. Sariomanoglu-SC; *Liverpool Hospital, Liverpool, Australia*: R. Dignan-PI, J. French-LC, M. Gonzalez-SC; *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; *Zala County Hospital and Pécs University, Zalaegerszeg, Hungary*: N. Alotti-PI, G. Lupkovics-SC; *Cleveland Clinic Foundation, Cleveland, USA*: N. Smedira-PI, J. Pryce-SC; *Onassis Cardiac Surgery Center, Athens, Greece*: D. Cokkinos-PI, G.

Palatianos-LS, D. Kremastinos-LC; University Hospitals of Cleveland, Cleveland, USA; R. Stewart-PI, L. Rinke-SC; University of Medicine and Dentistry of New Jersey-Newark, Newark, USA; B. Esrig-PI, M. Baptiste-SC; University of Kentucky Gill Heart Institute, Lexington, USA; D. Booth-PI, C. Ramaiah-LS, V. Ferraris-LS; Lindner Clinical Trial Center, Cincinnati, USA; S. Menon-PI, L. Martin-SC; Brigham and Women's Hospital, Boston, USA; G. Couper-PI, D. Rosborough-SC; UZ Gasthuisberg/University Hospitals, Leuven, Belgium; J. Vanhaecke-PI, A. Strijckmans-SC; **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), P. Desvigne-Nickens, R. Jones, K. Lee, R. Michler, C. O'Connor, J. Oh, G. Rankin, E. Velazquez; Policy and Publication Committee: J. Hill (chair), F. Beyersdorf, R. Bonow, P. Desvigne-Nickens, R. Jones, K. Lee, J. Oh, J. Panza, J. Rouleau, Z. Sadowski, E. Velazquez, H. White; **Coordinating Center Clinical Leadership:** R. Jones, E. Velazquez, C. O'Connor; **Project Management:** G. Rankin, M. Sellers; **Site Management:** B. Sparrow-Parker, A. McCormick, J. Albright, R. Dandridge, L. Rittenhouse; **Data Management:** D. Wagstaff, N. Wakeley, S. Burns, M. Williams, D. Bailey, L. Parrish, H. Daniels, G. Grissom, K. Medlin; **Statistics:** K. Lee, L. She, A. McDaniel, Y. Lokhnygina; **Clinical Events Coordination:** D. Greene; **Project Support:** V. Moore; **Cardiac Magnetic Resonance Core Laboratory:** G. Pohost (director), S. Agarwal, P. Apte, P. Bahukha, M. Chow, X. Chu, M. Doyle, J. Forder, M. Ocon, V. Reddy, N. Santos, R. Tripathi, P. Varadarajan; **Echocardiography Core Laboratory:** J. Oh (director), F. Blahnik, C. Bruce, G. Lin, B. Manahan, D. Miller, F. Miller, P. Pellikka, R. Springer, J. Welper, H. Wiste; **Economics and Quality of Life Core Laboratory:** D. Mark (director), K. Anstrom, K. Baloch, A. Burnette, N. Clapp-Channing, 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, M. Diamond, A. Maisel, D. Mann, D. McNamara; **Radionuclide Core Laboratory:** R. Bonow (director), D. Berman, D. Helmer, T. Holly, S. Leonard, M. Woods; **DECIPHER Ancillary Study:** J. Panza (director), M. McNulty; **MR TEE Ancillary Study:** P. Grayburn (director), S. Aston.

**ONLINE APPENDIX TABLE 1: HYPOTHESIS 2 COMPLIANCE WITH TREATMENT ASSIGNED BY RANDOMIZATION**

499 Patients Assigned CABG			501 Patients Assigned CABG + SVR	
Reason	Patients		Patients	Reason
Cardiac	1	died before operation	5	3 definite cardiac cause
4 patients declined 3 patients worsened 1 provider decision	8	no operation at one year	7	5 patients declined 1 patient worsened 1 provider decision
8 provider decision	8	alternate operation chosen before operation	12	7 provider decision 2 patients declined 3 miscommunication
6 operative difficulty 13 operative finding	19	alternate operation chosen during operation	23	4 operative difficulty 19 operative finding
	36	did not receive assigned operation	47	
	463 (92.8%)	assigned operation performed	454 (90.6%)	
		917 (91.7%) of patients received operation assigned		

**ONLINE APPENDIX TABLE 2: OPERATIVE CONDUCT BY TREATMENT ARM (as randomized)**

Variables	CABG (N = 490)	CABG with SVR (N = 489)	P
<b><i>Surgical Data</i></b>			
Acuteness at operation			
Elective	413 (84%)	406 (83%)	0.54
Urgent	62 (13%)	65 (13%)	
Ongoing ischemia	9 (2%)	12 (2%)	
Hemodynamic instability	2 (0.4%)	2 (0.4%)	
Salvage	3 (0.6%)	4 (0.8%)	
Off-pump bypass	50 (10%)	6 (1%)	<0.001
Cardioplegia			
None	73 (15%)	13 (3%)	
Crystalloid	90 (18%)	116 (24%)	
Blood	307 (63%)	338 (69%)	
Both	19 (4%)	22 (4%)	
Number of conduits			0.49
1	40 (8%)	33 (7%)	
2	134 (27%)	156 (32%)	
3	214 (44%)	203 (42%)	
4	89 (18%)	86 (18%)	
5	11 (2%)	10 (2%)	
6 or more	2 (0.4%)	1 (0.2%)	
Number of arterial conduits			0.008
0	33 (7%)	56 (11%)	
1	403 (82%)	392 (80%)	
2	42 (9%)	31 (6%)	
3	12 (2%)	9 (2%)	
4	0	1 (0.2%)	
5 or more	0	0	

Number of venous conduits			0.59
0	52 (11%)	36 (7%)	
1	138 (28%)	150 (31%)	
2	199 (41%)	201 (41%)	
3	87 (18%)	84 (17%)	
4	11 (2%)	13 (3%)	
5	0	2 (0.4%)	
Other	2 (0.4%)	1 (0.2%)	
Number of distal anastomoses			0.34
0	0	0	
1	35 (7%)	36 (7%)	
2	95 (20%)	109 (22%)	
3	192 (40%)	188 (39%)	
4	123 (25%)	115 (24%)	
5	35 (7%)	33 (7%)	
6 or more	6 (1%)	6 (1%)	
Number of sequential grafts			0.87
0	345 (74%)	343 (74%)	
1	80 (17%)	79 (17%)	
2	24 (5%)	25 (5%)	
3	8 (2%)	8 (2%)	
4	2 (0.4%)	0	
5	0	0	
Other	7 (2%)	6 (1%)	
Other procedures (not including SVR)			
None	377 (77%)	366 (75%)	0.44
Mitral valve	85 (17%)	93 (19%)	0.50
Other	37 (8%)	39 (8%)	0.80
Types of procedures on mitral valve			0.034
Repair	76 (89%)	91 (98%)	
Bioprosthesis	4 (5%)	0	
Mechanical	5 (6%)	2 (2%)	



Prebypass time in OR, median (25 <sup>th</sup> , 75 <sup>th</sup> ), hours	2.3 (1.8, 2.7)	2.3 (1.9, 2.8)	0.44
Time on bypass pump, median (25 <sup>th</sup> , 75 <sup>th</sup> ), minutes	99 (73, 125)	124 (99, 158)	<0.001
Time on aortic crossclamp, median (25 <sup>th</sup> , 75 <sup>th</sup> ), minutes	62 (45, 84)	80 (62, 106)	<0.001
Post-bypass time in OR, median (25 <sup>th</sup> , 75 <sup>th</sup> ), hours	1.1 (0.9, 1.4)	1.1 (0.9, 1.4)	0.54
Total time in OR, median (25 <sup>th</sup> , 75%), hours	4.9 (4.1, 6.0)	5.5 (4.7, 6.6)	<0.001
Total intubation time, median (25 <sup>th</sup> , 75 <sup>th</sup> ), hours	15.1 (10.9, 22.1)	16.6 (12.0, 25.2)	0.002
Total time in CCU/ICU, median (25 <sup>th</sup> , 75 <sup>th</sup> ), hours	49.8 (28.8, 95.5)	69.5 (42.0, 137.3)	<0.001
Length of hospital stay after surgery, median (25 <sup>th</sup> , 75th), days			
USA	7.0 (5.0, 10.0)	9.0 (7.0, 17.0)	
Canada	7.0 (6.0, 11.0)	7.0 (6.0, 9.0)	
Europe	10.0 (7.0, 14.0)	11.0 (8.0, 15.0)	
Asia-Pacific	7.0 (6.0, 10.0)	9.0 (7.0, 11.0)	
South America	7.0 (7.0, 10.0)	10.5 (9.0, 17.0)	
All	8.0 (6.0, 13.0)	9.0 (7.0, 14.0)	<0.001
Hospital stay longer than 30 days after surgery	22 (5%)	31 (6%)	0.20

### **SVR Data**

Patients Randomized to SVR  
(N = 501)

Received SVR	454 (91%)
Patch	267 (59%)
No patch	186 (41%)
Beating heart	44 (10%)
Cardioplegia	408 (90%)

*Values are presented as number (%) unless otherwise indicated.*

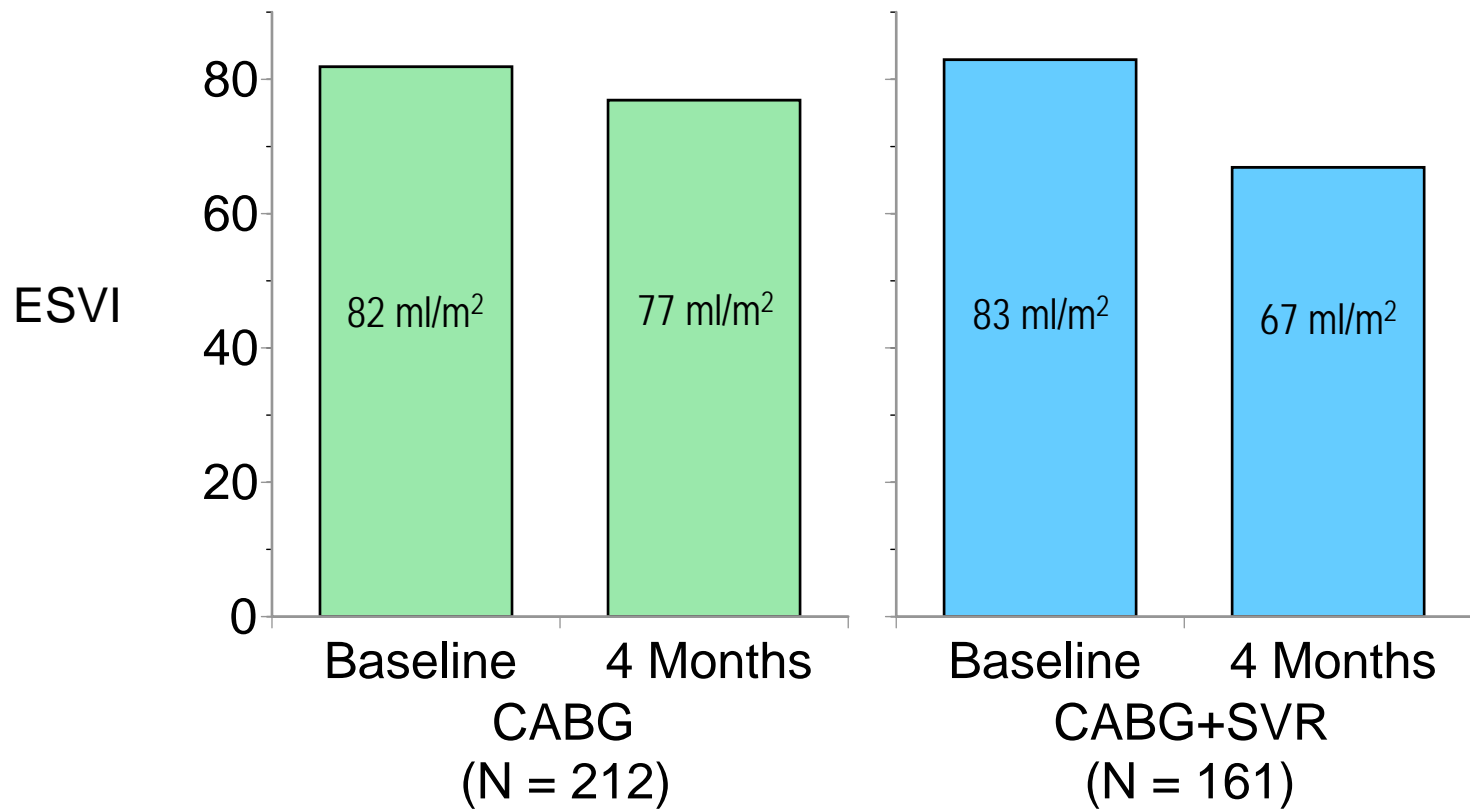
## ONLINE APPENDIX FIGURE LEGENDS

### Figure 1

Mean end-systolic volume index assessed by core laboratory quantitative echocardiogram in 373 patients at baseline and 4 months after CABG alone (N = 212) or CABG with surgical ventricular reconstruction (N = 161). The end-systolic volume enlargement at baseline was equivalent. However, CABG with surgical ventricular reconstruction reduced end-systolic volume index by 19% compared to a 6% decrease in the CABG only cohort ( $p < 0.001$ ).

### Figure 2

Six-minute walk at baseline in 1000 patients. (A) At baseline, both the CABG cohort (N = 499) and (B) CABG with surgical ventricular reconstruction cohort (N = 501) had similar numbers of patients unable to walk and symptomatic. At 4 months following CABG with or without surgical ventricular reconstruction, a similar increase in meters walked and decrease in symptomatic patients occurred in the two cohorts compared to baseline.



# 6-minute Walk

