Supplementary Online Content

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

eTable 1. Preoperative Cardiac Risk Factors and Postoperative Outcomes for Open Aortic Procedures

	2005 n=540	**2006 n=1,490**	**2007 n=2,539**	**2008 n=2,650**	**2009 n=2,791**	**2010 n=2,715**	**2011 n=2,611**	**2012 n=2,467**	**2013 n=2,540**	**2014 n=2,464**	**p-trend**
Preoperative Characteristics											
Male Gender, n (%)	378 (70.0%)	1,072 (71.9%)	1,821 (71.7%)	1,880 (70.9%)	1,997 (71.6%)	1,920 (70.7%)	1,834 (70.2%)	1,773 (71.9%)	1,867 (73.5%)	1,849 (75.0%)	<0.01
Age, mean±SD (years)	71.0±10.7	69.8±10.9	69.5±11.2	69.4±11.5	69.3±11.6	68.9±11.6	69.0±11.5	68.7±11.8	68.7±12.1	68.4±11.5	<0.01
Race											
White	463 (85.7%)	1,239 (83.2%)	2,189 (86.2%)	2,231 (84.2%)	2,231 (83.5%)	2,167 (79.1%)	2,081 (79.6%)	1,959 (79.4%)	1,949 (76.7%)	1,831 (74.3%)	<0.01
Black or African American	30 (5.6%)	103 (6.9%)	143 (5.6%)	187 (7.1%)	221 (7.9%)	220 (8.0%)	200 (7.7%)	206 (8.4%)	190 (7.5%)	201 (8.2%)	
Asian or Native American	5 (0.9%)	13 (0.9%)	35 (1.4%)	40 (1.5%)	54 (1.9%)	66 (2.4%)	74 (2.8%)	76 (3.1%)	73 (2.9%)	61 (2.5%)	
Others / Un-known	42 (7.8%)	135 (9.1%)	172 (6.8%)	192 (7.3%)	185 (6.6%)	287 (10.5%)	260 (9.9%)	226 (9.2%)	328 (12.9%)	371 (15.1%)	
BMI, mean±SD (kg/m^2)	27.1±5.4	27.4±5.8	27.5±5.6	27.6±5.9	27.6±5.7	27.6±6.8	27.3±5.8	27.9±5.8	27.5±5.8	27.9±5.7	<0.01
Diabetes requir-ing Insulin	22 (4.1%)	66 (4.4%)	85 (3.4%)	111 (4.2%)	133 (4.8%)	142 (5.2%)	114 (4.4%)	107 (4.3%)	91 (3.6%)	101 (4.1%)	0.94
Hypertension	438 (81.3%)	1,186 (79.6%)	2,012 (79.24%)	2,109 (79.6%)	2,221 (79.6%)	2,155 (78.7%)	2,057 (78.7%)	1,898 (76.9%)	1,908 (75.1%)	1,818 (73.8%)	<0.01

Anemia	191 (35.4%)	556 (37.3%)	950 (37.4%)	1,034 (39.0%)	1,108 (39.7%)	1,124 (41.0%)	1,040 (39.8%)	925 (37.5%)	951 (37.4%)	922 (37.4%)	0.89
Renal Insufficiency	157 (29.1%)	352 (23.6%)	614 (24.2%)	651 (24.6%)	638 (22.9%)	624 (22.8%)	553 (21.2%)	502 (20.35%)	540 (21.3%)	508 (20.6%)	<0.01
Dialysis	16 (3.0%)	29 (2.0%)	66 (2.6%)	89 (3.4%)	95 (3.4%)	93 (3.5%)	103 (3.9%)	81 (3.3%)	96 (3.8%)	106 (4.3%)	<0.01
h/o CHF	9 (1.7%)	35 (2.4%)	43 (1.7%)	45 (1.7%)	56 (2.0%)	71 (2.6%)	67 (2.6%)	51 (2.1%)	64 (2.5%)	65 (2.6%)	0.01
h/o MI	15 (2.8%)	30 (2.0%)	68 (2.7%)	54 (2.0%)	65 (2.3%)	70 (2.6%)	35 (2.5%)	17 (2.2%)	N/A	N/A	0.86
h/o Stroke	85 (15.7%)	231 (15.5%)	371 (14.6%)	407 (15.4%)	419 (15.0%)	412 (15.0%)	181 (6.9%)	128 (5.2%)	N/A	N/A	0.28
ASA Class											
I	1 (0.2%)	6 (0.4%)	8 (0.3%)	8 (0.3%)	18 (0.7%)	13 (0.5%)	10 (0.4%)	8 (0.3%)	14 (0.6%)	8 (0.3%)	<0.01
II	58 (10.7%)	120 (8.1%)	188 (7.4%)	205 (7.8%)	204 (7.3%)	198 (7.3%)	168 (6.4%)	178 (7.2%)	198 (7.8%)	148 (6.0%)	
III	324 (60.0%)	891 (59.8%)	1,473 (58.1%)	1,501 (56.8%)	1,582 (56.7%)	1,505 (55.1%)	1,418 (54.4%)	1,280 (54.0%)	1,278 (50.5%)	1,220 (49.7%)	
IV	132 (24.4%)	401 (26.9%)	765 (30.2%)	798 (30.2%)	856 (30.7%)	902 (33.0%)	905 (34.7%)	873 (35.5%)	876 (34.6%)	918 (37.4%)	
V	25 (4.6%)	72 (4.8%)	101 (4.0%)	133 (5.0%)	130 (4.7%)	114 (4.2%)	108 (4.1%)	121 (4.9%)	165 (6.5%)	162 (6.6%)	
Dependent Functional Status	86 (15.9%)	219 (14.7%)	344 (13.6%)	353 (13.3%)	379 (13.6%)	297 (10.8%)	161 (6.2%)	92 (3.7%)	95 (3.7%)	70 (2.8%)	<0.01
MICA Risk Estimate, mean±SD (%)	4.3±6.2	4.0±5.7	4.0±5.3	4.2±5.9	4.0±5.2	3.9±4.9	3.5±4.0	3.4±3.4	3.6±3.8	3.6±3.6	0.14
Emergent Procedure	98 (18.2%)	315 (21.1%)	511 (20.1%)	543 (20.5%)	559 (20.0%)	623 (22.7%)	563 (21.5%)	512 (20.8%)	577 (22.7%)	551 (22.4%)	<0.01

Postoperative Outcomes											
Myocardial Infarction	3 (0.6%)	18 (1.2%)	18 (0.7%)	29 (1.1%)	90 (3.2%)	82 (3.0%)	71 (2.7%)	76 (3.1%)	69 (2.7%)	76 (3.1%)	0.64*
Cardiac Arrest	10 (1.9%)	40 (2.7%)	61 (2.4%)	73 (2.8%)	65 (2.3%)	78 (2.9%)	84 (3.2%)	89 (3.6%)	117 (4.6%)	115 (4.7%)	<0.01
Mortality	45 (8.3%)	125 (8.4%)	195 (7.7%)	264 (10.0%)	235 (8.4%)	227 (8.3%)	201 (7.7%)	207 (8.4%)	246 (9.7%)	250 (10.2%)	0.04

*p-trend and total incidence for MI was calculated using data 2009-2014 only.

eTable 2. Preoperative Cardiac Risk Factors and Postoperative Outcomes for Peripheral Bypass Procedures

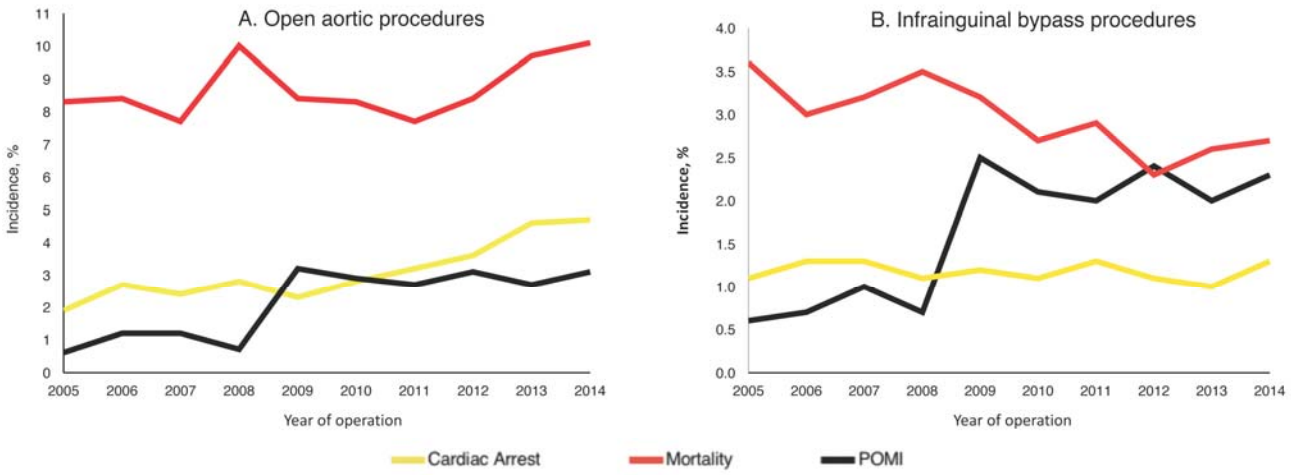
	2005 n=952	**2006 n=3,191**	**2007 n=5,308**	**2008 n=6,428**	**2009 n=7,533**	**2010 n=7,818**	**2011 n=8,089**	**2012 n=8,588**	**2013 n=9,566**	**2014 n=9,921**	**p-trend**
Preoperative Characteristics											
Male Gender, n (%)	599 (62.9%)	1,950 (61.1%)	3,271 (61.6%)	3,853 (59.9%)	4,637 (61.6%)	4,803 (61.4%)	5,047 (62.4%)	5,312 (61.9%)	5,998 (62.7%)	6,375 (64.3%)	<0.01
Age, mean±SD (years)	64.7±12.7	66.0±12.2	66.8±12.0	67.0±12.2	66.7±11.9	66.9±11.8	66.7±11.5	66.9±11.5	66.9±11.3	66.3±11.3	0.35
Race											
White	743 (78.1%)	2,466 (77.3%)	4,133 (77.9%)	5,053 (78.6%)	5,869 (77.9%)	5.932 (75.3%)	6,082 (75.1%)	6,443 (75.0%)	7,063 (73.8%)	7,259 (73.2%)	<0.01
Black or African American	127 (13.3%)	378 (11.9%)	747 (14.1%)	863 (13.4%)	1,020 (13.5%)	1,077 (13.7%)	1,175 (14.5%)	1,164 (13.6%)	1,444 (15.1%)	1,508 (15.2%)	
Asian or Native American	11 (1.2%)	19 (0.6%)	74 (1.4%)	61 (1.0%)	130 (1.73%)	109 (1.4%)	138 (1.7%)	207 (2.4%)	195 (2.0%)	149 (1.5%)	
Others / Unknown	71 (7.5%)	328 (10.3%)	355 (6.7%)	451 (7.0%)	515 (6.8%)	760 (9.7%)	705 (8.7%)	774 (9.0%)	864 (9.0%)	1,005 (10.1%)	
BMI, mean±SD (kg/m^2)	26.9±6.4	27.2±6.2	26.9±6.2	26.9±6.2	27.1±6.1	27.3±6.4	27.1±6.3	27.3±6.1	27.4±6.0	27.5±6.0	<0.01
Diabetes requiring Insulin	174 (18.3%)	594 (18.6%)	965 (18.2%)	1,207 (18.8%)	1,478 (19.6%)	1,524 (19.4%)	1,625 (20.1%)	1,781 (20.7%)	1,979 (20.7%)	2,118 (21.4%)	<0.01
Hypertension	767 (80.6%)	2,625 (82.3%)	4,296 (80.9%)	5,227 (81.3%)	6,208 (82.4%)	6,515 (82.7%)	6,726 (83.0%)	7,041 (82.0%)	7,799 (81.5%)	7,905 (79.7%)	0.03

Anemia	446 (46.9%)	1,517 (47.5%)	2,440 (46.0%)	3,014 (46.9%)	3,500 (46.5%)	3,675 (46.7%)	3,681 (45.4%)	3,826 (44.6%)	4,091 (42.8%)	4,191 (42.2%)	<0.01
Renal insufficiency	230 (24.2%)	840 (26.3%)	1,162 (21.9%)	1,271 (19.8%)	1,481 (19.7%)	1,601 (20.3%)	1,446 (17.9%)	1,567 (18.3%)	1,650 (17.3%)	1,662 (18.8%)	<0.01
Dialysis	52 (5.5%)	197 (6.2%)	324 (6.1%)	343 (5.3%)	401 (5.3%)	420 (5.3%)	396 (4.9%)	418 (4.9%)	445 (4.7%)	405 (4.1%)	<0.01
h/o CHF	26 (2.7%)	109 (3.4%)	138 (2.6%)	163 (2.5%)	169 (2.2%)	197 (2.5%)	200 (2.5%)	220 (2.6%)	260 (2.7%)	289 (2.9%)	0.56
h/o MI	30 (3.2%)	88 (2.8%)	110 (2.1%)	127 (2.0%)	172 (2.3%)	158 (2.0%)	91 (2.0%)	66 (2.5%)	N/A	N/A	0.16
h/o Stroke	179 (18.8%)	584 (18.3%)	999 (18.8%)	11,242 (19.3%)	1,411 (18.7%)	1,506 (19.1%)	711 (8.8%)	488 (5.7%)	N/A	N/A	0.34
ASA Class											
I	6 (0.6%)	14 (0.4%)	17 (0.3%)	19 (0.3%)	20 (0.3%)	16 (0.2%)	24 (0.3%)	30 (0.4%)	23 (0.2%)	17 (0.2%)	<0.01
II	89 (9.4%)	250 (7.8%)	393 (7.4%)	440 (6.9%)	465 (6.2%)	456 (5.8%)	455 (5.6%)	413 (4.8%)	455 (4.8%)	442 (4.5%)	
III	690 (72.5%)	2,281 (71.5%)	3,788 (71.4%)	4,596 (71.5%)	5,370 (71.3%)	5,671 (72.0%)	5,715 (70.6%)	5,949 (69.4%)	6,600 (69.0%)	6,819 (68.8%)	
IV	163 (17.1%)	640 (20.1%)	1,085 (20.5%)	1,351 (21.0%)	1,653 (22.0%)	1,713 (21.8%)	1,867 (23.1%)	2,164 (25.2%)	2,453 (25.7%)	2,594 (26.2%)	
V	4 (0.4%)	6 (0.2%)	21 (0.4%)	19 (0.3%)	21 (0.3%)	20 (0.3%)	29 (0.4%)	22 (0.3%)	28 (0.3%)	36 (0.4%)	
Dependent Functional Status	174 (18.3%)	562 (17.6%)	890 (16.8%)	1,097 (17.1%)	1,183 (15.7%)	979 (12.4%)	754 (9.3%)	632 (7.4%)	682 (7.1%)	613 (6.2%)	<0.01
MICA Risk Estimate, mean±SD (%)	1.3±1.4	1.4±1.4	1.4±1.6	1.4±1.6	1.4±1.4	1.3±1.4	1.3±1.3	1.3±1.2	1.3±1.2	1.2±1.1	0.07
Emergent Procedure	93 (9.8%)	226 (7.1%)	391 (7.4%)	463 (7.2%)	550 (7.3%)	587 (7.5%)	658 (8.1%)	636 (7.4%)	716 (7.5%)	634 (6.4%)	0.05

Postoperative Outcomes											
Myocardial In-farction	6 (0.6%)	22 (0.7%)	51 (1.0%)	44 (0.7%)	189 (2.5%)	169 (2.2%)	165 (2.0%)	205 (2.4%)	193 (2.0%)	226 (2.3%)	0.52*
Cardiac Arrest	10 (1.1%)	41 (1.3%)	70 (1.3%)	71 (1.1%)	89 (1.2%)	87 (1.1%)	105 (1.3%)	93 (1.1%)	96 (1.0%)	127 (1.3%)	0.64
Mortality	34 (3.6%)	95 (3.0%)	171 (3.2%)	222 (3.5%)	242 (3.2%)	216 (2.7%)	233 (2.9%)	199 (2.3%)	253 (2.6%)	265 (2.7%)	<0.01

*p-trend for MI is calculated using data 2009-2014 only.

eFigure. Temporal Trends for Major Cardiac Complications, 2005-2014



Operation Year	Open Aortic MI	Open Aortic CA	Open Aortic Mortality	Bypass MI	Bypass CA	Bypass Mortality
2005	0.6	1.9	8.3	0.6	1.1	3.6
2006	1.2	2.7	8.4	0.7	1.3	3
2007	1.2	2.4	7.7	1	1.3	3.2
2008	0.7	2.8	10	0.7	1.1	3.5
2009	3.2	2.3	8.4	2.5	1.2	3.2
2010	2.9	2.8	8.3	2.1	1.1	2.7
2011	2.7	3.2	7.7	2	1.3	2.9
2012	3.1	3.6	8.4	2.4	1.1	2.3
2013	2.7	4.6	9.7	2	1	2.6
2014	3.1	4.7	10.1	2.3	1.3	2.7

Postoperative myocardial infarction (POMI) incidence remained stable before and after the 2008-2009 change in the sampling algorithm of the American College of Surgeons National Surgical Quality Improvement Program. Mortality and cardiac arrest (CA) gradually increased in open aortic procedures (A) but decreased in infrainguinal bypass (bypass) procedures (B). MI indicates myocardial infarction.