Title:

The Presence of a Dedicated Cardiac Surgical Intensive Care Service Impacts Clinical Outcomes in Adult Cardiac Surgery Patients

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Abstract

Background: Postoperative critical care management is an integral part of cardiac surgery that contributes directly to clinical outcomes. In the United States there remains considerable variability in the critical care infrastructure for cardiac surgical programs. There is little published data investigating the impact of a dedicated cardiac surgical intensive care service.

Methods: Retrospective study examining postoperative outcomes in cardiac surgical patients before and after the implementation of a dedicated cardiac surgical intensive care service at a single academic institution. An institutional Society of Thoracic Surgeons database was queried for study variables. Primary endpoints were postoperative length of stay, intensive care unit length of stay, and mechanical ventilation time. Secondary endpoints included mortality, readmission rates, and postoperative complications. The effect on outcomes based on procedure type was also analyzed.

Results: 1703 patients were included in this study—914 in the control group (before dedicated intensive care service) and 789 in the study group (after dedicated intensive care service). Baseline demographics were similar between groups. Length of stay, mechanical ventilation hours, and renal failure rate were significantly reduced in the study group. Coronary artery bypass grafting patients observed the greatest improvement in outcomes.

Conclusions: Implementation of a dedicated cardiac surgical intensive care service leads to significant improvements in clinical outcomes. The greatest benefit is seen in patients undergoing coronary artery bypass, the most common cardiac surgical operation in the United States. Thus, developing a cardiac surgical intensive care service may be a worthwhile initiative for any cardiac surgical program.

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Introduction

Ongoing emphasis on value-based care models in the United States has led to significant changes in the organizational structure of hospitals and delivery of care. One of the major focus areas has been in intensive care unit (ICU) and critical care infrastructure.[1] ICUs account for a relatively large proportion of healthcare costs; although hospital-specific data is difficult to obtain and can vary widely, some studies suggest that, in the United States, the average daily cost of an ICU stay is $3,500, with ICU expenditures representing 13% of hospital costs[2]. Effective critical care delivery is also associated with improved patient outcomes including reduced length of stay (LOS), ICU mortality rate, and in-hospital mortality.[3,4] A dedicated critical care team is a vital component necessary for this effective care delivery.

ICUs are broadly categorized into three models: 1) Open, 2) Closed, and 3) Hybrid or Collaborative.[2,5-9] The “Open” model is the traditional ICU where physicians of any specialty can admit patients and have autonomy for decision-making regarding their patients. Generally there is no intensivist dedicated specifically to caring for the ICU patients.[10] This model is often utilized in most of the non-academic, community hospitals throughout the nation.[2,5-8]

In the “Closed” ICU model, patients are admitted to the ICU by a critical care intensivist physician who is responsible for the clinical decision making while the patient is in the unit. When the patient transfers out of the ICU, a different physician assumes primary responsibility. The model can most commonly be seen in tertiary academic or university hospitals because of the availability of full-time faculty.[11]

Lastly, the “Hybrid or Collaborative” model is a combination of both the Open and Closed models. In this arrangement, both a primary team physician and an intensivist attend to the patient and share decision-making. This model is well suited for surgical patients whereby both surgeon and intensivist can leverage their respective expertise and collaboratively manage patient care. Like the closed model, the hybrid ICU model is commonly utilized in academic or tertiary care hospitals. [2,5-8] The common characteristic of the closed and hybrid models is the presence of a dedicated intensivist service.

Evidence suggests that the closed and hybrid models can improve outcomes, reduce ICU LOS, reduce mortality, and improve cost effectiveness.[4,8,12,13] Several studies have compared the various ICU care models, but most have investigated general medical or surgical ICUs. There have been few studies examining the effects of various ICU care delivery strategies in cardiac surgery programs. Cardiac surgical patients have high acuity and complexity, with essentially all requiring ICU care in the immediate postoperative period. These patients often require multi-organ system management. Furthermore, cardiac surgical procedures, particularly coronary artery bypass grafting (CABG), have long been the subject of intense scrutiny in the shift toward bundled and value-based care delivery. Postoperative critical care management plays an immediate and direct role in affecting outcomes following cardiac surgery and thus must be considered a core component of the cardiac surgical care pathway.

Our institution is an academic, university-affiliated tertiary referral center that provides the full spectrum of adult cardiac surgical services. Historically, our institution utilized the traditional open ICU model where the cardiac surgical team managed all aspects of patient care during the postoperative ICU stay. A critical care team was not involved in the care of cardiac surgical patients unless specifically requested by the cardiac surgeon. With joint input from hospital administration, cardiac surgeons, and critical care physicians, our institution recently converted to a hybrid, collaborative ICU model with the major change being the presence of a dedicated critical care service involved in the postoperative management of all cardiac surgical patients. The critical care team is composed of a board-certified pulmonologist/critical-care physician, critical care advanced practice providers (nurse practitioners and physician assistants), and rotating housestaff (trainee residents and fellows in surgery, emergency medicine, pulmonary/critical care, and thoracic surgery). Under the new ICU model, this critical care team rounded on every cardiac surgical patient and managed all aspects of care in conjunction with the cardiac surgical team. The critical care team was available 24 hours a day, with an advanced practice provider in-house during overnight hours supported by the intensivist physician on-call. We sought to analyze the effects of the new ICU care model by investigating outcomes of cardiac surgery patients before and after the transition.

Material and Methods

Cardiovascular Critical Care Unit Settings

The cardiovascular critical care (CVCC) unit at our institution is a 34-bed ICU located on 2 floors. Nursing administration and bedside care givers are the same on both floors. Nursing care is provided by dedicated CVCC nurses with a 1:1 to 1:3 ratio depending on patient acuity. The CVCC unit admits all postoperative cardiac surgical patients.

Study design

The Institutional Review Board of Indiana University approved all aspects of this retrospective study. We queried our institutional Society of Thoracic Surgeons (STS) database to identify all patients who underwent an index adult cardiac surgical operation during a four-year time period which included the two years before implementation of the dedicated critical care model and the two years after implementation. We included patients who underwent either isolated CABG, isolated valve surgery, or combination of CABG and valve surgery. These groups were included because our registries captured standardized data for these patients over the full study period and because these comprise the vast majority of our institution's patient population. Patients who underwent aortic surgery, heart or lung transplant, ventricular assist device (VAD) implantation, extracorporeal membrane oxygenation (ECMO) as an index operation, or approach via non-median sternotomy were excluded. Patients were divided into two groups indicated by the critical care care model provided: "Open" (those who underwent surgery in the two years before implementation of the dedicated critical care service) and "Hybrid" (those who underwent surgery in the two years after implementation of the dedicated critical care service). Intra- and post-operative variables were obtained from the STS database as well as individual patient medical records.

Statistical analysis

All analyses were performed using Stata/SE 14.2 (StatCorp LLC, College Station, Texas). Results are reported as mean+/-standard deviation (SD) for continuous variables and percentages for categorical variables. We performed bivariate analysis using Student's t-test for continuous variables and Pearson's chi-square tests for categorical variables to examine the differences between Open and Hybrid groups. To make inferences about population means of the primary outcome variables, we used multivariable Poisson regression with margins to report the marginal estimate of the Hybrid group compared to the Open group using pseudo-maximum likelihood methods with robust standard errors. For secondary binary outcomes, we used multivariable logistic regression with robust standard errors to report adjusted odds ratio of Hybrid outcomes compared to Open. Robust standard errors help account for any model misspecifications. Control variables used in the multivariable models were patient age, preoperative BMI, risk factors and comorbidities. The analysis was also done by stratifying the population into surgery type. All hypotheses were tested at 0.05 level of significance.

Results

There were a total of 1703 study patients: 914 in the Open group and 789 in the Hybrid group. Baseline characteristics including age, ethnicity, BMI, and cardiovascular risk factors were similar between groups (Table 1). The Hybrid group had higher rates of alcohol use and illicit drug use, while the Open group had higher rates of dialysis-dependent renal failure, cigarette use, and urgent/emergent cases (Table 1). Alcohol, cigarette, and illicit drug use history was self-reported by patients and were considered positive in cases of either past or current use. Isolated CABG was the most commonly performed procedure with 1071 cases (597 in Open and 474 in Hybrid). There were 413 isolated valve patients (200 in Open and 213 in Hybrid) and 219 combined CABG+valve cases (117 in Open and 102 in Hybrid). We followed STS definitions for procedure type, where “isolated valve” included aortic valve or mitral valve surgery. The majority of cases (53%) were classified as elective, followed by 42% as urgent, and 4% as emergent.

When comparing the entire study cohort, bivariate analysis revealed reductions in the rates of postoperative prolonged ventilation (9.38% vs. 14.44%, p=0.001) and postoperative renal failure (3.17% vs. 5.47%, p=0.021) but increased rates of postoperative gastrointestinal events (4.56% vs. 2.30%, p=0.010) in the Hybrid vs. Open group (Table 2). Multivariate analysis demonstrated significant improvements in the Hybrid group including lower overall post-operative LOS (11.4 days vs 10.3, p=0.001) and total mechanical ventilator time (35.6 hours vs

20.8 hours, p=0.002) (Table 3). There was a trend suggestive of improvement in initial mechanical ventilation time (16.9 hours vs. 12.9 hours, p=0.072). Reintubation rates were 7.4% in the Open group and 5.8% in the Hybrid group, although this was not significant (p=0.185). For patients that required reintubation, there was an almost significant (p=0.053) change whereby those in the Hybrid group remained intubated for a much shorter duration (119.8 hours) than those in the Open group (209.1 hours). Although there were more urgent and emergent cases in the Open group than in the Hybrid group (49.89% vs. 43.10%), there were no significant differences between the groups in mortality or major complication rates except for the aforementioned prolonged ventilation and renal failure.

Within specific procedure subgroups, the greatest improvements were seen in isolated CABG patients. In this subset, there were improvements in LOS (10.6 days vs. 9.4 days, p=0.006), initial ICU duration (105.2 hours vs. 83.1 hours, p=0.034), and total mechanical ventilation times (31.9 hours vs. 17.0 hours, p=0.011) (Table 3). Isolated valve and combined CABG+valve groups did not demonstrate significant improvements in the major primary outcomes measures, although both groups did have significant decreases in “additional ICU” time (defined as the duration of ICU care for any patients that are transferred back into the ICU during the index hospitalization).

Secondary outcomes including mortality at discharge, 30-day mortality, and readmission rate within 30 days was similar between groups without a significant change (Table 4). However, there were significant reductions in risks of prolonged ventilation (adjusted OR=0.54, p<0.0001) and of renal failure (adjusted OR 0.54, p=0.019) in the Hybrid group.

Discussion

Postoperative management of cardiac surgery patients is an integral factor affecting clinical outcomes. Numerous analyses have compared "open" and "closed" ICU models, which generally show more favorable outcomes for the latter.[3,4,12,14] These studies have examined a variety of specialty ICUs including neurological/neurosurgical ICU, general surgical ICU, and medical ICU. However, we do not know of any that have investigated cardiac surgical patients specifically. As a surrogate, we identified surveys examining staffing of medical cardiac ICUs: an American Heart Association study examined 612 centers (38% academic, 62% community-based) and found that 8% had a dedicated cardiology ICU, 25% had dedicated cardiology ICU based staffing, and 14% had dual-board certified cardiac intensivists practicing in the ICU.[15] Furthermore, only 10% of all cardiology ICUs (26% of academic institutions and 4% of community-based hospitals) met criteria to be classified as a Level 1 center. We conclude that we can reasonably extrapolate similarly low numbers of dedicated cardiac surgical ICUs.

Our analysis demonstrates that the presence of a dedicated critical care team for cardiac surgical patients leads to significant measurable improvements in clinical outcome parameters. Across all study patients as a whole, there was a decrease in total postoperative LOS by an average of 1.3 days and a reduction in total mechanical ventilator time by 14.8 hours. Isolated CABG saw the greatest improvements with reductions in total postoperative LOS, initial ICU time, and total mechanical ventilation time. Our results also demonstrate that patients who required transfer back to the CVCC during the index hospitalization saw significant benefit: the additional ICU time for the Hybrid group (compared to the Open group) was reduced by 115 hours in isolated valve surgery patients and by 262 hours for combined CABG+valve patients. In other words, the presence of a dedicated intensivist team led to much shorter CVCC readmission times than when managed by the surgical team alone.

It is important to note that during this study period of the new critical care model, there was not a particular rapid extubation or enhanced recovery protocol implemented. There was an informal goal of extubation within 24 hours of arrival from the operating room, but no defined protocol. Thus, our results demonstrate that the presence of a critical care team alone can lead to measurable improvements in clinical outcomes. We surmise that implementing additional ICU-specific recovery protocols, whether it be rapid extubation, multi-modal analgesia, or other quality-improvement measures, to this model would lead to even greater improvements in outcomes. We anticipate our future studies will address these interventions.

We did not study other clinical outcomes relevant to ICU care such as central line associated blood stream infection (CLABSI), urinary tract infections (UTI), or time to first mobility simply because these variables were not consistently measured prior to implementation of the critical care service model in our institution. As such, we could not accurately assess or attribute any change in these parameters to the hybrid ICU model. The greater number of cigarette users in the Open group (32.82% vs. 23.70%) may have contributed to prolonged postoperative ventilator time compared to the Hybrid group, although the postoperative pneumonia and reintubation rates were not different between the two. Furthermore, the cigarette smoking status was based upon patient reported use, either in the past or current, and thus not all "cigarette smokers" were active smokers at or immediately preceding surgery. The fact that isolated CABG patients in this study saw the greatest improvements is important with respect to potential magnitude of effects. Isolated CABG is the most commonly performed cardiac surgical operation in the United States, comprising 54% of all cardiac operations in 2016.[16] In our study, isolated CABG accounted for 62% of all cases. Consequently, interventions that positively benefit this subgroup wield a large impact simply based on the volume of patients.

Implementation of a dedicated cardiac surgical intensivist team is one systematic intervention that would affect the majority of cardiac surgical patients in most institutions.

Optimizing critical care delivery has also been associated with potential cost savings. While ICU costs vary across institutions, Gershengorn and associates found that the average surgical ICU costs $2,636 on day one and $1,840 for every subsequent day.[17] Dasta and colleagues found that mechanical ventilation results in a 62% greater cost than in non-intubated patients.[18] While we did not perform a formal cost-benefit analysis, we were able to obtain mean cost data for our institution: each CVCC day cost $4,578 while each ward (non-CVCC) day cost $3,044. These amounts were not linked to our specific study population, as that data was proprietary and not available for our analysis. Yet, these general values provide a rough estimate of potential cost savings. Based solely on improvements in LOS for our entire study cohort, we estimate that the implementation of the hybrid ICU model resulted in savings of $4,696 per patient. For isolated CABG alone, our estimated savings was $3,865 per patient.

Limitations of this study include those inherent to its retrospective and single institution nature. The surgical staff was not the same for the two study groups, and this certainly could have played a role in affecting outcomes. We hoped to address this by comparing the baseline demographics and types of operation between the two groups and demonstrating no significant difference. Secondly, our results do not examine a particular care intervention such as a rapid extubation or recovery protocol; rather, we demonstrate that even without any specific care protocol, the presence of a dedicated critical care team for daily postoperative care is, in and of itself, a factor that leads to measurable outcomes improvements. When examining renal failure outcomes, we could not distinguish between those cases which required renal replacement therapy versus those that did not primarily because our early data registries did not differentiate between them. Future studies could better delineate these as the two outcomes are clearly clinically different. Lastly, individual surgeon experience can certainly affect postoperative outcomes. This study was not designed to examine this question. Rather, because the study cohort involved patients of surgeons of varying experience levels, we believe the study results are more generalizable to different groups of surgeons and individual techniques.

Conclusion

Postoperative cardiac critical care is a vital part of care affecting patient outcomes. Our institutional experience shows that development of a dedicated intensivist service as part of a hybrid ICU model for cardiac surgical patients leads to significant measurable improvements in several clinical parameters across patient subgroups. Implementing this type of dedicated cardiac surgical ICU service may be a worthwhile endeavor for hospitals that offer cardiac surgical services.

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Table 1: Characteristics of Patients in Open and Hybrid Groups

Variable [a]	**Total Sample (n= 1703)**	**Open (n=914)**	**Hybrid (n= 789)**	**p value**
Age	62.90±11.68	63.39±11.67	62.33±11.68	0.0626
Gender				0.301
Male	1,144 (67.18)	604 (66.08)	540 (68.44)	
Female	559 (32.82)	310 (33.92)	249 (31.56)	
Race				0.039
White	1,423 (83.61)	782 (85.56)	641 (81.35)	
African American	230 (13.51)	112 (12.25)	118 (14.97)	
Other	49 (2.88)	20 (2.19)	29 (3.68)	
BMI[b]	30.54±10.16	30.64±11.06	30.43±9.00	0.6612
Endocarditis	71 (4.17)	33 (3.61)	38 (4.82)	0.214
Alcohol Use	1,338 (78.57)	668 (73.09)	670 (84.92)	<0.0001
Cerebrovascular Disease	263 (15.44)	142 (15.54)	121 (15.34)	0.909
Chronic Lung Disease	493 (28.95)	276 (30.20)	217 (27.50)	0.222
Diabetes	797 (46.80)	435 (47.59)	362 (45.88)	0.480
Dyslipidemia	1,397 (82.03)	742 (81.18)	655 (83.02)	0.325
Renal Fail-Dialysis	89 (5.23)	57 (6.24)	32 (4.06)	0.044
Hypertension	1,441 (84.62)	767 (83.92)	674 (85.42)	0.390
Carotid Stenosis	41 (2.41)	19 (2.08)	22 (2.79)	0.341
Illicit Drug Use	103 (6.05)	43 (4.70)	60 (7.60)	0.012
Immunocompromised	106 (6.22)	57 (6.24)	49 (6.21)	0.982
Peripheral Arterial Disease	315 (18.51)	166 (18.16)	149 (18.91)	0.692
Pneumonia	92 (5.40)	45 (4.92)	47 (5.96)	0.347
Cigarette smoker	487 (28.60)	300 (32.82)	187 (23.70)	<0.0001
Prior MI[c]	734 (43.10)	407 (44.53)	327 (41.44)	0.200
Heart Failure≤2 weeks	598 (35.11)	317 (34.68)	281 (35.61)	0.688
Cardiogenic Shock	49 (2.88)	34 (3.72)	15 (1.90)	0.025
Procedure Type				0.040
CABG only	1,071 (62.89)	597 (65.32)	474 (60.08)	
Valve only	413 (24.25)	200 (21.88)	213 (27.00)	
CABG+Valve	219 (12.86)	117 (12.80)	102 (12.93)	
Status				0.005
Elective	907 (53.26)	458 (50.11)	449 (56.91)	
Urgent	727 (42.69)	410 (44.86)	317 (40.18)	
Emergent	69 (4.05)	46 (5.03)	23 (2.92)	
Discharge Location				0.028
Home	1,273 (76.55)	661 (74.44)	612 (78.97)	
Extended/Transitional	342 (20.57)	194 (21.85)	148 (19.10)	
Other	48 (2.89)	33 (3.72)	15 (1.94)	

[a] Categorical data are shown as percentage of patients and continuous data as the mean±SD, [b] BMI=body mass index, [c] MI=myocardial infarction

Table 2: Postoperative Outcomes of patients in this study

Secondary Outcomes	**Total Sample (n=1703)**	**Open (n=914)**	**Hybrid (n=789)**	**p value**
Mortality at Discharge	40 (2.35)	26 (2.84)	14 (1.77)	0.146
30-day Mortality	48 (2.82)	29 (3.17)	19 (2.41)	0.447
Readmission <=30 Days	166 (9.75)	85 (9.30)	81 (10.27)	0.503
Postop Reintubation	114 (6.69)	68 (7.44)	46 (5.83)	0.185
Postop SSI[b]	19 (1.12)	11 (1.20)	8 (1.01)	0.710
Postop Pneumonia	101 (5.93)	52 (5.69)	49 (6.21)	0.650
Postop Prolonged Ventilation	206 (12.10)	132 (14.44)	74 (9.38)	0.001
Postop Renal Failure	75 (4.40)	50 (5.47)	25 (3.17)	0.021
Postop Atrial Fibrillation	374 (21.96)	197 (21.55)	177 (22.43)	0.662
Postop Gastrointestinal Event	57 (3.35)	21 (2.30)	36 (4.56)	0.010
Postop Multi-system Failure	26 (1.53)	16 (1.75)	10 (1.27)	0.417
Postop Stroke	31 (1.82)	12 (1.31)	19 (2.41)	0.092

[a] Categorical data are shown as percentage of patients and continuous data as the mean ± SD, [b] SSI = surgical site infection

Table 3: Multivariate Marginal Estimates after Poisson Regression for Primary Continuous Outcomes

	Open Estimates (95% CI)	**Hybrid Estimates (95% CI)**	**p value**
All Patients (n=1703)			
LOS	11.41(10.86-11.96)	10.13(9.63-10.64)	0.001
Initial ICU Hours	106.64(93.46-119.82)	93.78(86.54-101.02)	0.114
Additional ICU Hours	202.48(135.59-269.37)	138.72(76.99-200.46)	0.199
Total ICU Hours	117.86(106.75-128.97)	106.3(93.39-119.22)	0.181
Initial Ventilation Hours	16.92(13.57-20.27)	12.9(10.19-15.61)	0.072
Additional Ventilation Hours	209.12(145.98-272.26)	119.84(64.94-174.75)	0.053
Total Ventilation Hours	35.60(27.85-43.34)	20.82(15.82-25.82)	0.002
CABG Only (n=1071)			
LOS	10.56(9.96-11.17)	9.39(8.78-9.99)	0.006
Initial ICU Hours	105.17(87.38-122.96)	83.08(73.60-92.56)	0.034
Additional ICU Hours	161.75(102.27-221.23)	203.91(66.32-341.51)	0.600
Total ICU Hours	107.05(94.55-119.55)	102.28(82.96-121.60)	0.676
Initial Ventilation Hours	10.41(8.27-12.55)	8.89(6.74-11.04)	0.334
Additional Ventilation Hours	209.83(145.45-274.21)	146.76(62.30-231.22)	0.220
Total Ventilation Hours	31.93(22.80-41.05)	17.03(10.27-23.78)	0.011
Valve Only (n=413)			
LOS	11.95(10.55-13.35)	11.81(10.52-13.10)	0.886
Initial ICU Hours	103.17(91.16-115.18)	104.82(93.21-116.44)	0.844
Additional ICU Hours	206.13(100.87-311.40)	90.93(62.76-119.11)	0.040
Total ICU Hours	130.29(106.11-154.46	110.56(96.46-124.66)	0.179
Initial Ventilation Hours	22.24(14.26-30.21)	14.35(9.66-19.04)	0.073
Additional Ventilation Hours	284.69(139.53-429.86)	105.59(45.03-166.14)	0.031
Total Ventilation Hours	42.88(20.48-65.26)	20.34(12.95-27.73)	0.081
CABG+Valve (n=219)			
LOS	13.51(11.64-15.38)	11.45(10.03-12.88)	0.076
Initial ICU Hours	111.55(95.59-127.50)	127.39(106.72-148.07)	0.209
Additional ICU Hours	325.38(84.10-566.67)	62.81(21.36-146.97)	0.049
Total ICU Hours	144.96(107.30-182.62	111.46(88.44-134.49)	0.119
Initial Ventilation Hours	32.98(19.26-46.69)	31.85(15.20-48.50)	0.924
Additional Ventilation Hours	78.46(39.13-117.79)	83.74(57.03-110.45)	0.842
Total Ventilation Hours	40.46(26.51-54.40)	37.57(20.51-54.63)	0.799

Table 4: Multivariate Logistic Regression Analysis for Secondary Outcomes

	Odds Ratio (95%CI)	p value
All Patients (n=1703)		
Mortality at Discharge	0.59 (0.29-1.18)	0.135
30-day mortality	0.76 (0.42-1.40)	0.387
Readmission <=30 Days	1.04 (0.75-1.45)	0.808
Postop Pneumonia	1.04 (0.68-1.58)	0.859
Postop Prolong Ventilation	0.54 (0.39-0.75)	<0.0001
Postop Renal Failure	0.54 (0.33-0.91)	0.019
CABG Only (n=1071)		
Mortality at Discharge	0.48 (0.18-1.28)	0.140
30-day mortality	0.61 (0.26-1.42)	0.254
Readmission <=30 Days	0.89 (0.58-1.38)	0.607
Postop Pneumonia	1.04 (0.59-1.84)	0.893
Postop Prolong Ventilation	0.44 (0.27-0.71)	0.001
Postop Renal Failure	0.65 (0.34-1.24)	0.190
Valve Only (n=413)		
Mortality at Discharge	0.73 (0.22-2.44)	0.606
30-day mortality	1.01 (0.32-3.22)	0.988
Readmission <=30 Days	1.55 (0.82-2.89)	0.175
Postop Pneumonia	1.21 (0.59-2.49)	0.605
Postop Prolong Ventilation	0.80 (0.45-1.42)	0.449
Postop Renal Failure	0.33 (0.13-0.86)	0.023
CABG+Valve (n=219)		
Mortality at Discharge	1.07 (0.21-5.35)	0.935
30-day mortality	1.31 (0.30-5.79)	0.720
Readmission <=30 Days	0.96 (0.35-2.58)	0.928
Postop Pneumonia	0.63 (0.21-1.88)	0.407
Postop Prolong Ventilation	0.53 (0.27-1.05)	0.069
Postop Renal Failure	0.59 (0.16-2.17)	0.425