

ACQUIRED CARDIOVASCULAR DISEASE

ORIGINAL ARTICLES

Prevalence and Procedural Outcomes of Percutaneous Coronary Intervention and Coronary Artery Bypass Grafting in Patients with Diabetes and Multivessel Coronary Artery Disease

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ABSTRACT ***Background:*** **Percutaneous coronary intervention (PCI) is used with increasing frequency in patients with diabetes and multivessel disease. This study investigated evolving revascularization strategies in the State of Washington.** ***Methods:*** **The Clinical Outcomes Assessment Program captures all revascularization in the State of Washington and was used to compare diabetic patients with multivessel disease undergoing first-time revascularization from 1999 to 2007. Categorical variables were compared with the chi-squared test and continuous variables were compared with the student's *t*-test. Results were risk-adjusted using a logistic regression.** ***Results:*** **A total of 11,602 patients with diabetes and multivessel disease underwent revascularization from 1999 to 2007 and were nearly equally divided between coronary artery bypass grafting (CABG) (51%) and PCI (49%). Patients undergoing CABG had a higher ($p < 0.0001$) prevalence of congestive heart failure, cerebrovascular disease, peripheral vascular disease, three-vessel coronary artery disease (CAD), and intraaortic balloon pump insertion, but a lower prevalence of female gender, cardiogenic shock, and emergency procedures. Patients undergoing CABG had more ($p < 0.0001$) three-vessel CAD and more complete revascularization (3.7 vs. 1.5 lesions treated). Short-term risk-adjusted mortality was equivalent. The prevalence of PCI increased from 34.1% in 1999 to 59.4% in 2007.** ***Conclusions:*** **PCI is applied with increasing frequency to patients with diabetes mellitus (DM) and multivessel disease. PCI is used most commonly in two-vessel CAD or with acute coronary syndromes with more limited and targeted revascularization. CABG is more commonly applied to extensive disease with more complete revascularization. Both the prevalence and percentage of patients undergoing PCI as primary therapy for multivessel disease with DM is increasing. A multidisciplinary approach may be warranted to ensure optimal outcomes.**
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The optimal initial revascularization strategy for patients with diabetes mellitus (DM) with multivessel (MVD) coronary artery disease remains controversial. This debate has been compounded by the clinical introduction of drug-eluting stents (DESs) in January 2004 and the early data indicating a decrease in the restenosis rates relative to bare metal stents and angioplasty. Subsequently, there has been a surge of interest in applying the new and improved PCI technologies and their associated intensified medical therapies such as statins and dual antiplatelet therapy, to diabetic patients with MVD. In the United States the number of people with DM is 23.6 million and rising, one-quarter of whom are unaware they have the disease.[1,2] Diabetic patients are two to four times more likely to develop significant coronary artery disease (CAD) than nondiabetics, shortening life expectancy on average by seven to eight years.[3] Nearly 25% of the 1.3 million

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revascularization interventions in the United States are performed on diabetics. Following revascularization, either with percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG), diabetics experience increased morbidity and mortality.

Numerous comparative trials have been initiated in the Unites States and Europe to compare PCI with DES to CABG, which has been the gold standard for revascularization in patients with DM and MVD.[4-6] In fact, even in the recent ACCF/SCAI/STS/AATS/AHA/ASNC 2009 Appropriateness Criteria for Coronary Revascularization, PCI for diabetics with MVD was listed as "uncertain," as most of these studies excluded patients with diabetes.[7] The purpose of this study is to examine the application of revascularization strategy in this high-risk patient population in a real-world/clinical practice setting. Specifically, it was sought to determine: (1) the revascularization strategies employed in diabetic patients with MVD in Washington State; (2) the short-term outcomes of revascularization strategies; and (3) the effect of DES introduction has had on the revascularization strategy.

MATERIALS AND METHODS

Clinical outcomes assessment program

The Clinical Outcomes Assessment Program (COAP) of the State of Washington is a comprehensive quality improvement initiative between the Washington State Health Care Authority, physicians, and hospitals.[8] COAP captures 100% of the cardiac care programs in the State of Washington, and focuses on coronary revascularization procedures. COAP is currently sponsored by the Foundation for Health Care Quality, a 510c(3) not-for-profit entity that facilitates public-private partnerships in health care. The Foundation for Health Care Quality did not play a role in data analysis or interpretation; rather all analysis and interpretation was performed by the authors. COAP is governed by a voluntary, unpaid management committee consisting of cardiac surgeons, cardiologists, administrators, and quality-improvement experts. Approval for this investigation was secured from the University of Washington Internal Review Board (Approval No. 28604). A list of current participating centers is provided in the Appendix.

Patient population

This study includes patients who had DM and MVD and underwent a first cardiac revascularization procedure between 1999 and 2007. Patients undergoing concomitant cardiac procedures were excluded. DM was identified preoperatively by clinical diagnosis, and does not distinguish between diabetics controlled by dietary modification, oral hypoglycemics, or insulin injection. During this time period, there were 154,602 revascularization procedures (CABG and PCI) performed at 30 centers, 95,384 of which were first-time revascularization procedures. MVD was present in 48,860 patients (31.6%). A total of 21,746 patients (44.5%) underwent CABG and 27,114 patients (55.5%) underwent PCI. A total of 5,992 patients (27.6%) undergoing CABG and 5,610 patients (20.7%) undergoing PCI had DM.

The COAP database contains extensive information relating to patient demographics, comorbidities, clinical presentation, procedure characteristics, and outcome data. The COAP database uses definitions consistent with the Society of Thoracic Surgeon's National Database. COAP is not able to collect long-term follow-up information, and is limited to information and outcomes of the index hospitalization. Since its inception, the database has been modified periodically, and there have been ongoing efforts to improve the case report forms and ensure data validity and reliability. Data were transmitted to a central contractor responsible for constructing a single database.

The following medical history variables were assessed: congestive heart failure, hypertension, pulmonary disease, cerebrovascular disease, peripheral vascular disease, and cigarette smoking. Angina severity was assessed by the Canadian Cardiovascular Society Classification, which was not collected in the last two years of the study. MVD was defined as having left main stenosis $\geq$50% stenosis and/or two or more lesions $\geq$70% in the right, left anterior descending (LAD), or circumflex systems. Left ventricular function was defined as normal ejection fraction (EF) ($\geq$ 50%), moderately reduced EF (30% to 49%), or severely reduced EF ($<$30%). The use of intraaortic balloon pump and/or the presence of cardiogenic shock on admission were assessed. Myocardial infarction is defined by a rise in cardiac biomarkers indicating myonecrosis accompanied with either symptoms or electrocardiographic changes.

Procedure priority was defined as elective, urgent, emergent, or salvage. For CABG, the mean number of bypass grafts; and for PCI, the number of lesions intervened upon defined the extent of revascularization. Short-term outcomes included hospital death, periprocedure stroke, postprocedure renal failure requiring hemodialysis, postrevascularization myocardial infarction, postprocedure length of stay, red blood cell transfusion, or return to operating room/catheterization laboratory for any reason.

Statistical methods

We compared characteristics and outcomes of patients undergoing CABG and PCI with the chi-square statistic for categorical variables and the student's *t*-test for continuous variables. For each procedure, we examined trends in patient characteristics and outcomes for the following time periods: 1999-2000, 2001-2003, and 2004-2007. The last time period was specifically chosen to reflect trends since the widespread approval of DESs. The chi-square statistic was used for categorical variables and the one-way analysis of variance for continuous variables.

Hospital outcomes comparing CABG and PCI were risk adjusted. First, a propensity score measuring the likelihood of undergoing CABG was computed with logistic regression. The following variables were included

in the score and were statistically significant ($p < 0.05$) predictors of undergoing CABG: (1) age in years, (2) male gender, (3) EF <30%, (4) creatinine > 2.0 mg/dL, (5) emergency priority, (6) history of congestive heart failure, (7) history of chronic obstructive pulmonary disease, (8) history of cerebrovascular disease, (9) the number of diseased vessels, (10) cardiogenic shock, (11) history of peripheral vascular disease, (12) left main lesion >50%, and (13) LAD lesion >70%. Second, to assess the association between procedure type and outcome, the propensity score, year of procedure, and procedure type variable were included in logistic regression models for categorical outcomes, and in a linear regression model for length of stay. Third, p values were adjusted for clustering of procedures within hospitals with the Huber-White Sandwich Estimator.

RESULTS

The total number of PCI performed increased by 2.5 fold from 288 procedures in 1999 to 722 procedures in 2007 (Fig. 1). The total number of CABG performed decreased from 555 procedures in 1999 to 492 procedures in 2007, with a peak in 2003 with 838 procedures. The percentage of patients undergoing PCI as initial therapy has dramatically increased from 1999 to 2007 in patients with and without DM (Fig. 2). This trend is evident at all hospitals that offer both CABG and PCI, irrespective of hospital procedural volumes, as shown in Figure 3.

Overall baseline and procedural characteristics of both groups are depicted in Table 1. Patients undergoing CABG were more likely to be male (70% vs. 60%, $p < 0.0001$). Comorbidities were also increased in the CABG patients, including congestive heart failure, hypertension, pulmonary disease, cerebrovascular disease, peripheral vascular disease, and history of smoking ($p < 0.01$ for all). The majority of patients had angina, although the Canadian Class breakdown was somewhat different between groups. Left ventricular EF was similar between CABG and PCI groups. Seventy-four percent of CABG patients had three-vessel disease, while only 35% of patients treated with PCI had three-vessel disease ($p < 0.0001$). CABG patients underwent an average of 3.7 grafts per patient, compared to 1.4 lesions treated per patient in those undergoing PCI ($p < 0.0001$). Although CABG patients were more likely to be elective (57% vs. 50%), there were significantly greater urgent patients undergoing CABG (39% vs. 28%). Emergent procedures were much more likely in the PCI group (22% vs. 4%). Salvage patients remain very rare, comprising less than 1% of each group. CABG patients were significantly more likely to have an intraaortic balloon pump compared with PCI patients (5.6% vs. 1.7%), while cardiogenic shock was more common in the PCI group (4.3% vs. 1.7%).

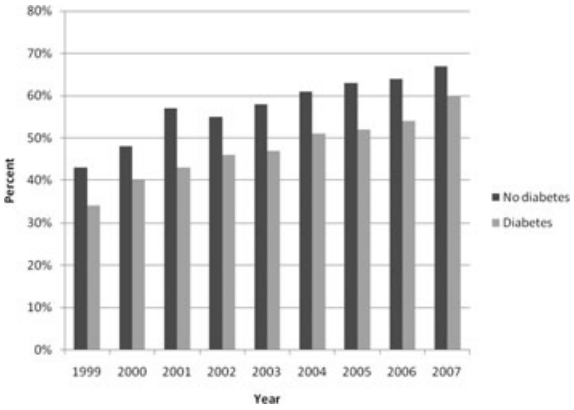

Figure 2. *Percentage of all patients with MVD undergoing revascularization by PCI.*

Hospital outcomes were risk adjusted for the likelihood of undergoing CABG, year of procedure, and for clustering within hospitals. CABG patients had a higher periprocedural stroke (1.7% vs. 0.5%) and dialysis (1.9% vs. 1.0%) rate, longer length of stay (6.7 vs. 2.7 days), higher transfusion rate (45% vs. 7%), and a higher return to operating room (OR) rate (4.2% vs. 2.4%). Short-term mortality was statistically superior for CABG (2.6% vs. 3.4%, $p = 0.013$), but when risk adjustment was conducted, the short-term mortality was statistically equivalent ($p = 0.43$).

Table 2 summarizes the data for CABG patients by time period. There was a statistically significant decrease in percentage of women, prevalence of

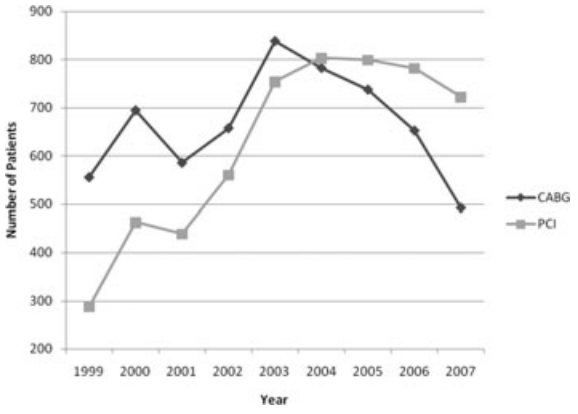

Figure 1. *Number of patients with DM and MVD undergoing revascularization.*

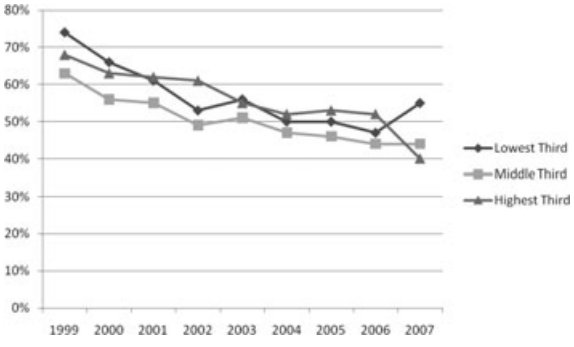

Figure 3. *Percentage of patients with DM and MVD undergoing CABG in the State of Washington, divided by total hospital procedural volume.*

TABLE 1
Characteristics and Risk-Adjusted Outcomes of CABG and PCI Patients with DM and MVD

Variable	CABG (n = 5992)	PCI (n = 5610)	p-Value
Age	66 ± 10	66 ± 12	0.93
Women	30%	40%	<0.0001
History			
Congestive heart failure	24%	18%	<0.0001
Hypertension	83%	81%	0.013
Pulmonary disease	16%	14%	0.008
Cerebrovascular disease	17%	14%	<0.0001
Peripheral vascular disease	22%	14%	<0.0001
Cigarette smoking	61%	55%	<0.0001
Canadian Class*			<0.0001
No angina	14%	17%	
I	3%	4%	
II	14%	14%	
III	38%	29%	
IV	31%	36%	
Left ventricular (LV) ejection fraction			0.035
<30	8%	8%	
30-49	29%	27%	
≥ 50	63%	65%	
Number diseased vessels			<0.0001
2	26%	65%	
3	74%	35%	
Mean number grafts/number lesions attempted	3.7 ± 1.1	1.4 ± 0.7	<0.0001
Procedure priority			<0.0001
Elective	57%	50%	
Urgent	39%	28%	
Emergent	4%	22%	
Salvage	<1%	<1%	
Balloon pump	5.6%	1.7%	<0.0001
Cardiogenic shock	1.7%	4.3%	<0.0001
Hospital death	2.6%	3.4%	0.43
Postoperative stroke	1.7%	0.5%	<0.0001
Postoperative dialysis	1.9%	1.0%	0.024
Postprocedure length of stay (days)	6.7 ± 6.3	2.7 ± 4.0	<0.0001
Red blood cell transfusion*	45%	7%	<0.0001
Return to OR for any reason	4.2%	2.4%	0.001

*Not collected for PCI in 2006 or 2007.

congestive heart failure, cigarette smoking, and two-vessel CAD. There was a statistically significant increase in hypertension, EF, three-vessel CAD, and left main CAD. There was an increase in Canadian Class III symptoms, while there was a decrease in Canadian Class IV symptoms. Elective and emergent procedures decreased, while urgent procedures increased. Both intraaortic balloon pump support and cardiogenic shock decreased over the time period. Outcomes improved significantly, with a decreased mortality (3.1% to 2.1%), decreased perioperative stroke rate (2.1% to 1.3%), decreased need for hemodialysis (2.7% to 1.7%), decreased perioperative myocardial infarction rate (1.6% to 0.8%), decreased blood transfusion rate (50% to 42%), and increased early extubation time (37% to 55%). Length of stay increased slightly from 6.7 to 6.9 days. Although not significantly significant, this represents a 27% decrease in mortality and 37% decrease in stroke and renal failure rates for CABG. This is important in comparison to PCI outcomes that have remained static over the time period.

Table 3 summarizes the characteristics of patients undergoing PCI by time period. There is a statistically significant increase in hypertension and pulmonary disease, and a decrease in cigarette smoking. There was also an increase in Canadian Class symptomatology, with a dramatic decrease in the number of asymptomatic patients. Left ventricular EF increased. Although not statistically significant, there was a trend toward fewer patients with two-vessel disease and more patients with three-vessel disease. The number of treated lesions increased from 1.2 per patient to 1.5 per patient. Patient priority did not change appreciably; however, there was a statistically significant increase in patients treated for acute myocardial infarction. There was no significant change in mortality, stroke, dialysis, length of stay, or transfusion rate. Unplanned CABG could not be fully evaluated as it is a new field entry. In the most recent period, less than 0.5% of patients required an unplanned CABG.

CONCLUSIONS

This investigation sought to characterize the current revascularization therapies for patients with DM and MVD in the State of Washington, and to illustrate

TABLE 2
Characteristics and Outcomes of CABG Patients with DM and MVD, Divided by Time Period

Variable	1999-2000 (n = 1249)	2001-2003 (n = 2080)	2004-2007 (n = 2663)	Total (n = 5992)	p-Value
Age	65 ± 10	66 ± 10	66 ± 10	66 ± 10	0.46
Women	33%	30%	29%	30%	0.018
History					
Congestive heart failure	32%	24%	19%*	24%	<0.0001
Hypertension	78%	81%	87%	83%	<0.0001
Pulmonary disease	15%	17%	16%	16%	0.29
Cerebrovascular disease	18%	18%	17%	17%	0.46
Peripheral vascular disease	21%	21%	22%	22%	0.70
Cigarette smoking	64%	62%	58%	61%	<0.0001
Canadian Class**					
No angina	14%	14%	12%	14%	
I	4%	2%	3%	3%	
II	14%	14%	14%	14%	
III	34%	38%	42%	38%	
IV	34%	32%	29%	31%	
LV ejection fraction					0.004
<30	9%	9%	7%	8%	
30-49	32%	29%	28%	29%	
≥50	60%	62%	65%	63%	
Number diseased vessels					<0.0001
2	30%	25%	24%	26%	
3	70%	75%	76%	74%	
Left main lesion ≥ 50%	25%	29%	33%	30%	<0.0001
LAD lesion ≥ 70%	86%	88%	88%	88%	0.35
Mean number grafts	3.8 ± 1.2	3.7 ± 1.2	3.6 ± 1.1	3.7 ± 1.1	<0.0001
Procedure priority					<0.0001
Elective	60%	57%	55%	57%	
Urgent	34%	39%	42%	39%	
Emergent	5%	4%	3%	4%	
Salvage	<1%	0%	<1%	<1%	
Balloon pump	7.8%	5.0%	5.2%	5.6%	0.002
Cardiogenic shock	2.5%	1.0%	1.8%	1.7%	0.004
Hospital death	3.1%	2.9%	2.1%	2.6%	0.08
Postoperative stroke	2.1%	1.9%	1.3%	1.7%	0.11
Postoperative dialysis	2.7%	1.9%	1.7%	1.9%	0.08
Postoperative myocardial infarction	1.6%	1.3%	0.8%	1.3%	0.13
Postprocedure length of stay (days)	6.7 ± 6.5	6.3 ± 5.4	6.9 ± 6.9	6.6 ± 5.8	0.006
Return to operating room for any reason	4.2%	4.0%	4.3%	4.2%	0.87
Red blood cell transfusion	50%	48%	42%	45%	<0.0001
Ventilator time <6 hours	37%	50%	55%	51%	<0.0001

*Possible problems with coding of Congestive Heart Failure (CHF) variable in 2004.
**Not collected in 2006 or 2007.

real-world contemporary clinical practice by reporting the risk characteristic and outcomes of 11,602 patient with DM and MVD treated over a nine-year period, representing one of the largest series of patients with this profile in the literature. The COAP database captures all revascularization procedures in the State of Washington, and is thus able to carefully document changes in patient-care delivery. We recently reported overall trends in coronary revascularization in the State of Washington.[9] There has been a dramatic increase in the application of PCI to all patients with CAD, and those with DM and MVD are no exception. Despite results of multiple studies demonstrating improved outcomes for patients with DM and MVD with CABG, absolute numbers and percentage of patients undergoing PCI in this patient population has increased 2.5-fold over the study period (Figs 1 and 2).

Recent literature is replete with both randomized and nonrandomized studies comparing CABG to PCI for patients with MVD.[4-6,10-14] These studies have consistently shown a benefit of CABG over PCI in patients with MVD and DM.[10-14] However, these long-term data have been criticized as reflecting bare metal stent technologies and less-optimal medical therapy, despite evidence that suggests that survival advantage and prevalence of myocardial infarction have not been shown to be improved in the general population by DESs versus bare metal stents.[15] There have been more recent publications, with more limited follow-up, but more representative of modern medical and stent therapy.[4,5] These studies demonstrated that CABG was associated lower major adverse events and low-revascularization rates and associated with lower mortality when compared to DESs. These effects were particularly notable when comparing patients with three-vessel CAD and DM. Publication of the SYNTAX trial further corroborated these findings in nondiabetic patients with multivessel disease.[6] Investigators

TABLE 3
Characteristics and Outcomes of PCI Patients with DM and MVD, Divided by Time Period

Variable	1999-2000 (n = 751)	2001-2003 (n = 1753)	2004-2007 (n = 3106)	Total (n = 5610)	p-Value
Age	65 ± 12	65 ± 12	66 ± 11	66 ± 12	0.15
Women	43%	40%	38%	40%	0.076
History					
Congestive heart failure	17%	19%	17%	18%	0.42
Hypertension	75%	78%	84%	81%	<0.0001
Pulmonary disease	12%	13%	15%	14%	0.005
Cerebrovascular disease	13%	14%	14%	14%	0.58
Peripheral vascular disease	12%	14%	15%	14%	0.34
Cigarette smoking	59%	56%	54%	55%	0.022
Canadian Class*					<0.0001
No angina	29%	17%	13%	17%	
I	2%	3%	6%	4%	
II	11%	14%	16%	14%	
III	24%	32%	28%	29%	
IV	33%	35%	37%	36%	
LV ejection fraction					0.047
<30	10%	8%	7%	8%	
30-49	30%	27%	26%	27%	
≥50	60%	66%	66%	65%	
Number diseased vessels					0.08
2	68%	64%	65%	65%	
3	32%	36%	35%	35%	
Left main lesion ≥50%	5%	5%	6%	5%	0.43
LAD lesion ≥70%	76%	80%	79%	79%	0.07
Number attempted lesions	1.2 ± 0.6	1.4 ± 0.6	1.5 ± 0.8	1.4 ± 0.7	<0.0001
Procedure priority					0.31
Elective	52%	51%	49%	50%	
Urgent	25%	27%	29%	28%	
Emergent	22%	22%	21%	22%	
Salvage	<1%	<1%	1%	<1%	
Balloon pump	2.0%	1.7%	1.7%	1.7%	0.79
Cardiogenic shock	5.3%	4.3%	4.1%	4.3%	0.34
Procedure performed for myocardial infarction	22%	25%	28%	26%	0.006
Hospital death	4.1%	2.9%	3.4%	3.4%	0.29
Postoperative stroke	0.5%	0.5%	0.4%	0.5%	0.85
Postoperative dialysis	1.1%	1.0%	1.1%	1.0%	0.94
Postprocedure length of stay (days)	2.8 ± 4.0	2.7 ± 3.7	2.7 ± 4.1	2.7 ± 4.0	0.28
Red blood cell transfusion*	7.5%	7.2%	5.9%	6.7%	0.26
Return to OR for any reason**	3.5%	2.8%	2.0%	2.4%	0.027
Unplanned CABG same admission (primary PCI)	–	–	0.4%	–	
Unplanned CABG same admission (nonprimary PCI)	–	–	0.3%	–	

*Not collected in 2006 or 2007.
**In 2006 and 2007 only return to OR for CABG was reported.

demonstrated that prospectively matched patients had lower rates of major adverse coronary or cerebrovascular events at one year after CABG, and patients with more diffuse disease benefitted more from surgical revascularization than PCI. Finally, a collaborative analysis of ten recent randomized trials comparing CABG to PCI was published.[16] In this analysis, there was a survival benefit for CABG in patients with DM, as well as those over 65 years of age. Unfortunately, none of these studies was sufficiently powered nor focused on patients with DM and MVD.

The recently published ACCF/SCAI/STS/AATS/AHA/ASNC 2009 Appropriateness Criteria for Coronary Revascularization included patients with advanced coronary artery disease.[7] Distinction was made for patients with both DM and reduced EF. Based upon prevailing data and expert opinion, patients with two-vessel disease, both with and without DM, and both with and without depressed EF, were deemed suitable for either CABG or PCI. For patients with three-vessel disease, CABG was always found "Appropriate," while PCI was deemed "Uncertain." For patients with left main disease of any kind, PCI was found to be "Inappropriate." The authors cautioned that use of these criteria should serve as guidelines rather than absolutes, due to lack of sufficient data to compare DES to CABG in these subsets. Nonetheless, CABG is superior to PCI in patients with DM and MVD, unless there are specific patient related risk factors that should sway this general recommendation.

The introduction of DES in 2003 was thought to have dramatically changed management of multivessel CAD. This perception is challenged by our data. As can be seen in Figure 1, the accelerated use of PCI preceded the introduction of DES, and in fact plateaued or decreased after DESs were widely used by 2004. Although it is true that all patients undergoing CABG dramatically decreased over this time period, it may be

argued that advances in medical therapy, along with the results of the COURAGE trial, have tempered enthusiasm for revascularization procedures in asymptomatic patients.[17] This concept is refuted by the fact that the overall prevalence of revascularization the state has increased by 32% in the past decade. PCI now far exceeds CABG as initial therapy even in patients with DM and MVD. In 2007, the number of patients with DM and MVD in the State of Washington treated with PCI is currently 1.5 the prevalence of those undergoing CABG (722 vs. 492, in 2007), despite both short- and long-term data supporting the superiority of CABG in this patient population. The extent of revascularization did not change appreciably over the study period, as patients undergoing CABG had 3.6 vessels treated compared to 1.5 in those treated with PCI (2.4 fold difference). Further, despite all of these patients having at least two-vessel disease, along with an increasing percentage having three-vessel disease in the most recent time period, the number of treated lesions per patient in the PCI group remains well under two. Further, this metric for PCI represents lesions treated rather than vessels treated, possibly further under-representing the degree of revascularization. Since patients undergoing PCI are more likely to be treated emergently, this suggests a specific practice of focused or target lesion revascularization rather than an emphasis on complete revascularization. This strategy appears to be safe, with acceptable short-term morbidity and mortality for both PCI and CABG over the study period, but may be a contributing factor for need for repeat revascularization and increased adverse events over time.

Results of the ongoing FREEDOM trial may help elucidate relative benefits of treatment strategies in this population.[18] This trial began enrollment in 2005, well after DESs were well established. It has neared its enrollment of 1900 patients with DM and MVD and will certainly provide an important contribution to our collective decisionmaking. On the other hand, this report includes more than 11,600 patients in a real-world, nonrandomized setting, and treatment strategy no longer seems controversial in the hands of practitioners. This study demonstrates the majority of patients with DM and MVD undergo PCI as initial therapy. Suggestion has been made that the increase in emergent coding for PCI is a direct result of policy that requires surgical backup for PCI, which is waived in the emergent setting. There has been a large increase in patients treated by PCI for acute myocardial infarction (22% to 28% comparing the first and last time period). Indeed, the number of emergent CABGs has concomitantly decreased from 5% to 3% in the same interval. This trend has further manifest itself by the relatively static morbidity and mortality statistics following PCI, despite advances in imaging, technical facility of the operators, and improvement in stent technology.

This study has limitations. First, due to the large numbers of patients and procedures in this study, clinically insignificant changes, even those less than 5%, reach high-statistical significance. Also, this study only examines short-term follow-up as it is limited to index hospitalization, and is based upon a limited data set. Therefore, examination of major adverse coronary and cerebrovascular events is not possible. Further, prospective risk adjustment by either the STS or Euroscore is not possible.

Attempts to settle the controversy between PCI and CABG for patients with DM and MVD may continue indefinitely in the literature, but, we can conclude that in the State of Washington, PCI is favored by more than 1.5:1 in this high-risk patient group. This discrepancy between real-world practice and recent literature and guidelines may represent an opportunity for collaboration and cooperation among cardiac caregivers. A multidisciplinary approach to patient care in coronary revascularization has recently been corroborated in the design and implementation of the SYNTAX trial. Many authors have championed this concept, both in a prospective and a hybrid approach.[19,20] It is conceivable, and perhaps appropriate, that this management paradigm will help ensure the most appropriate and efficient use of scarce resources.

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APPENDIX
Current COAP Participating Hospitals in the State of Washington

Auburn Regional Medical Center	Auburn
Capital Medical Center	Olympia
Central Washington Hospital	Wenatchee
Deaconess Medical Center	Spokane
Evergreen Hospital Medical Center	Kirkland
Good Samaritan Hospital	Puyallup
Harborview Medical Center	Seattle
Harrison Medical Center	Bremerton
Highline Medical Center	Burien
Kadlec Medical Center	Richland
Madigan Army Medical Center	Tacoma
Northwest Hospital & Medical Center	Seattle
Overlake Hospital Medical Center	Bellevue
Providence Holy Family Hospital	Spokane
Providence Regional Medical Center Everett	Everett
Providence Sacred Heart Medical Center	Spokane
Providence St. Peter Hospital	Olympia
Skagit Valley Hospital	Mount Vernon
St. Anthony Hospital	Gig Harbor
St. Francis Hospital	Federal Way
St. Joseph Hospital	Bellingham
St. Joseph Medical Center	Tacoma
Southwest Washington Medical Center	Vancouver
Stevens Hospital	Edmonds
Swedish Health Services	Seattle
Tacoma General Hospital	Tacoma
University of Washington Medical Center	Seattle
Valley Medical Center	Renton
Veterans Affairs Medical Center	Seattle
Virginia Mason Medical Center	Seattle
Yakima Regional Medical & Heart Center	Yakima
Yakima Valley Memorial Hospital	Yakima