Differential Outcome of Medical Therapy Compared with PCI and CABG in Individuals with CKD at Low, Medium, or High Cardiovascular Risk

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Introduction

- Prior publications on comparisons of medical therapy (MT) and percutaneous (PCI) or surgical coronary revascularization (CABG) for the treatment of coronary artery disease (CAD) in the setting of chronic kidney disease (CKD) suggest that MT is inferior.

- Prior analyses have been limited by the failure to identify an appropriate MT cohort—typically defined as absence of PCI/CABG (rather than presence of appropriate MT).

- Prior studies also confounded by failure to adequately account for baseline cardiovascular (CV) risk.

- We hypothesized that MT is superior to PCI/CABG in CKD pts at low CV risk but PCI and CABG are superior when CV risk is high.

Methods

- Data source: 20% Medicare sample (2007-2012)

Inclusion criteria:
- CKD patients with a qualifying event of stress testing or cardiac catheterization or hospital admission due to acute myocardial infarction (AMI) or acute coronary syndrome (ACS).
- Continuous enrollment in Medicare Parts A and B ≥180 days prior to qualifying event and until therapy index date.
- Continuous enrollment in Medicare Part D ≥180 days before qualifying event and ≥180 days after qualifying event or until death if < 6months.
- Received PCI or CABG within 60 days of qualifying event OR survive at least 4 days and received medical therapy.

Exclusion criteria:
- Concomitant valve surgery; prior CABG, PCI, or valve surgery.
- Preexisting ESRD.

Follow-up:
- From therapy date until death, disenrollment from any Medicare parts A/B/D, or 12/31/2012.

Definitions:
- PCI and CABG were assessed in the 60 days following the qualifying event. If both occurred on same day, patient was excluded.
- If no CABG or PCI, patients who survived ≥4 days after the qualifying event were assessed for medical therapy. Medical therapy was defined as an increase in the number of drug classes prescribed within 180 days.
- Medication classes considered were: Lipid lowering agents including statins, ACEi/ARB, anti-platelet, anti-anginals other than beta blockers and beta blockers.
- Therapy date: procedure date if PCI/CABG; prescription fill date if medical therapy.

Risk group stratification:
- Low: stress test or cardiac catheterization with no history of CVD.
- Medium: stress test or cardiac catheterization with history of CVD.
- High: ACS/AMI.

Statistical analysis:
- Patient characteristics and unadjusted rates of mortality and ESRD were described using descriptive statistics.
- Kaplan-Meier method was used to describe the cumulative probability of death and ESRD with log-rank tests used to evaluate the differences among therapies.

Results

Table 1. Cohort creation

Process Step	N remaining
Identify patients with first instance of stress test, cardiac catheterization or admission due to AMI/ACS in 2007-2012	3,165,396
Look backwards from the qualifying event to January 1, 2007 and exclude patients with valve surgery, or prior CABG/PCI.	2,862,675
Require ≥180 days continuous enrollment in Medicare parts A and B after the qualifying event, age of 18+, and residency of 50 states	2,104,183
Identify patients with CKD prior to the qualifying event	230,910
Exclude those with ESRD prior to the qualifying event	194,064
Require Medicare part D coverage for ≥180 days before and for ≥180 days or until death after the qualifying event	103,882
Identify patients with CABG or PCI within 60 days of qualifying event or with medical therapy (final cohort)	34,670

Table 3. Event rate, overall and by follow-up interval

	Low			Medium			High		
	PCI	CABG	Medical	PCI	CABG	Medical	PCI	CABG	Medical
ESRD (per 100 pt.-yrs.)									
Overall	3.8	4.4	3.9	3.6	5.3	3.6	4.1	6.4	3.8
<90 days	14.6	27.5	9.2	15.9	21.6	7.3	18.6	29.6	9.8
≥90 days	2.5	1.7	3.3	2.1	3.2	3.1	2.1	3.4	2.7
Mortality (per 100 pt.-yrs.)									
Overall	9.2	9.1	8.7	13.7	14.9	14.3	18.5	13.2	35.9
<90 days	14.8	27.2	9.6	21.2	46.9	16.8	56.6	42.8	64.8
≥90 days	8.6	7.0	8.5	12.8	10.8	14.0	13.6	9.6	30.9

Table 2. Patient baseline characteristics

	Low Risk (n=8,353)			Medium Risk (n=12,041)			High Risk (n=14,276)		
	PCI	CABG	Medical	PCI	CABG	Medical	PCI	CABG	Medical
Overall, N	1,000	562	6,791	713	713	9,577	4,541	1,477	8,258
% risk category total	12.0	6.7	81.3	14.5	5.9	79.5	31.8	10.3	57.8
Age, Mean years(SD)	72.2(9.3)	72.0(8.6)	70.7(11.7)	74.2(9.5)	73(9.2)	73.7(11.0)	75.0(10.5)	72.6(8.8)	80.3(11.4)
Age, %									
18-65 years	14.9	12.6	22.3	14.9	11.9	16.4	12.9	11.8	8.3
65-74 years	43.3	46.8	37.1	37.4	41.1	32.1	31.5	45.6	18.8
75-84 years	34.0	36.1	31.5	38.3	40.5	36.8	36.9	36.7	30.9
85+ years	7.8	4.5	9.1	12.5	6.5	14.7	18.7	5.9	42.1
Male, %	54.8	63.9	44.2	49.5	60.3	45.4	50.1	63.5	38.2
Race, %									
White	79.9	86.1	69.0	79.4	83.2	72.4	81.4	81.8	76.5
Black	13.0	7.7	21.7	13.1	8.7	20.0	11.4	10.1	16.2
Asian	2.0	2.9	3.4	2.3	2.5	2.5	2.2	2.7	2.5
Hispanic	2.8	*	3.5	3.2	3.4	3.1	2.6	2.5	3.0
Other/Unknown	2.3	2.1	2.4	2.0	2.2	2.0	2.4	2.9	1.8
Comorbid conditions, %									
ACS			*	0.7	*	0.5	0.6	*	1.1
CAD			0.6	40.4	32.5	34.3	16.2	12.8	18.3
CHF	14.0	12.5	17.7	29.4	25.8	32.6	15.7	10.3	25.3
Diabetes	50.6	50.5	44.2	58.9	55.4	51.1	45.1	50.2	41.5
CVA/TIA	1.5	2.0	1.9	13.0	11.9	15.0	7.6	5.8	12.5
PAD/PVD			0.6	25.0	27.9	28.1	12.1	11.7	19.0
Other cardiac disease	5.4	14.1	7.4	11.0	23.3	13.5	5.2	5.4	8.3
COPD	13.7	8.4	17.3	25.4	18.7	26.4	16.7	10.4	22.3
GI bleed/PUD/reflux			2.3	2.7	2.8	4.1	1.7	1.2	3.7
Liver disease	1.3	*	2.4	1.1	0.9	1.0			
Dysrhythmia	13.8	14.1	18.2	25.5	21.5	30.0	12.4	8.5	19.5
Anemia	21.2	21.2	27.2	29.4	28.5	35.0	19.8	16.6	31.8
Cancer	8.1	5.7	7.5	6.4	7.2	8.3	6.5	5.4	7.1

Figure 1. Cumulative probability of mortality by risk group and baseline therapy

Log-rank test (Low Risk): CABG vs. Medical: P=0.65; PCI vs. Medical: P=0.42

Log-rank test (Medium Risk): CABG vs. Medical: P=0.60; PCI vs. Medical: P=0.37

Log-rank test (High Risk): CABG vs. Medical: P<0.001; PCI vs. Medical: P<0.001
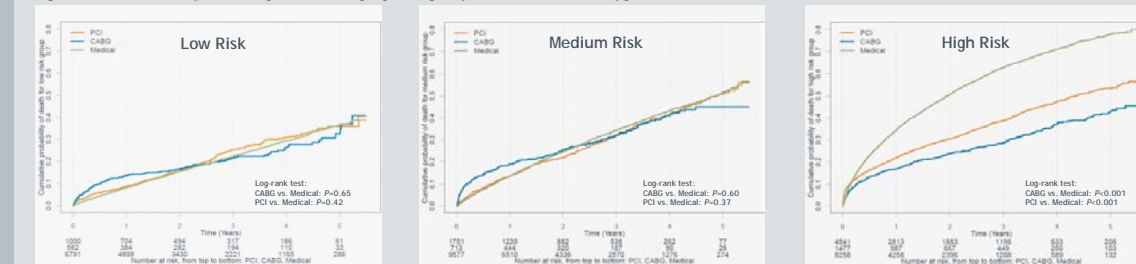
Figure 2. Cumulative probability of ESRD by risk group and baseline therapy

Log-rank test (Low Risk): CABG vs. Medical: P=0.35; PCI vs. Medical: P=0.85

Log-rank test (Medium Risk): CABG vs. Medical: P=0.003; PCI vs. Medical: P=0.92

Log-rank test (High Risk): CABG vs. Medical: P<0.001; PCI vs. Medical: P<0.01
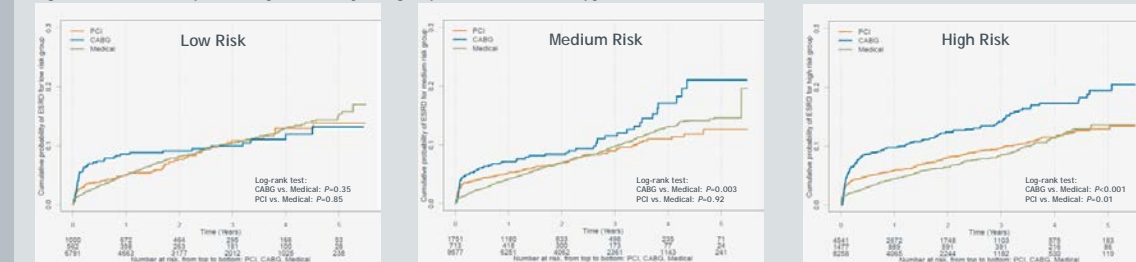
Summary

- Of 34,670 CKD patients available in this study, 8353(24%), 12,041(35%), and 14,276(41%) were at low, medium, and high risk.

- All-cause mortality rates increased across risk groups, consistent with excellent performance of our classification metric.

- Mortality rates per 100 patient-years were lowest with MT in the low risk group (PCI 9.2, CABG 9.1, MT 8.7) and medium risk groups (PCI 13.7, CABG 14.9, MT 14.3). In contrast, survival was markedly better with CABG or PCI in high risk patients (PCI 18.5, CABG 13.2, MT 35.9).

- We observed disproportionately high early mortality rates in the first 90 days following PCI/CABG across all risk groups, but only in high risk patients who received medical therapy.

Conclusions

- The relative benefits of medical therapy and coronary revascularization in CKD patients may vary according to pre-treatment CV risk.

- For patients at low or medium risk, medical therapy, PCI, and CABG have similar survival. In contrast, revascularization, particularly CABG, is associated with markedly improved survival but higher ESRD rate compared to medical therapy after ACS.

Limitations:
- Probability of ESRD not adjusted for competing risk of all cause mortality.
- Probabilities of ESRD and mortality were unadjusted.
- Observational study/likely selection bias.

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