

## Abstract and Background

DOES CORONARY ARTERY BYPASS (CABG) IMPROVE SURVIVAL IN PATIENTS WITH END STAGE RENAL DISEASE (ESRD)?  
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**Background:** Cardiovascular disease remains the most frequent cause of mortality for patients with ESRD. To determine the benefits from revascularization in this high-risk population, we reviewed our CABG patients with ESRD.  
**Methods:** From January 1995 through May 2002, 145 ESRD dialysis patients, underwent CABG: 55 patients (37.9%) off-pump, and 90 patients (62.1%) done using cardiopulmonary bypass (CPB). Preoperative risk factors and operative results were reviewed, along with longitudinal survival data.  
**Results:** Mean follow-up time was 23 months (range 0-76), with a mean survival of 36.4 months. Patients revascularized off-pump had an operative mortality of 1.9% while patients grafted using CPB had an operative mortality of 18.7% (p=0.003). The off-pump predicted risk of mortality (9.17% ± 7.59) was not statistically different from the on-pump risk (8.00% ± 7.62). Logistic regression analysis indicates that CPB use was an independent predictor of mortality p=0.02 (Odds Ratio =12.6, 95% CI: 1.6, 94.0).  
**Conclusion:** Coronary revascularization in ESRD does not improve survival when compared to the historic mortality of 23% per year in dialysis patients (United States Renal Data System). Initially, off-pump bypass grafting improves short-term mortality when compared with conventional revascularization, but this benefit is lost after one year.

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To determine the benefits from revascularization in this high-risk population, we reviewed our coronary artery bypass (CABG) patients with ESRD.

## Methods

### Patient Population:

- 145 End-Stage Renal Dialysis, undergoing Coronary Artery Bypass Grafting
- 55 patients (37.9%) grafted off-pump
- 90 patients (62.1%) grafted using cardiopulmonary bypass (CPB).

### Excluded Patients:

- patients in cardiogenic shock, needing resuscitation, and emergent or salvage status

### Study Period:

- January 1995 - May 2002,

### Preoperative Risk Factors:

- Analyzed using Chi-square and T-test statistics

### Post-operative Complications and Outcomes:

- Analyzed using Chi-square statistics

### Long-Term Followup:

- Long term followup obtained by telephone, physician contact or using the national death index.

### Survival Curves:

- Kaplan-Meier Analysis with right-censored points shown as circles
- Reference curve (Estimated Survival-Dialysis Patient) is estimated at constant 23% / year decrease (from USRDS) split into two semi-annual decrements.

## Results

- Patient followup in this study:

Mean: 23 ± 21 months,  
Range: 0 - 76 months  
Median: 15 months.

### Risk Factors

- On-Pump group has an increased incidence of pulmonary disease, three vessel disease and history of myocardial infarction.

On and Off-Pump groups are not different in incidence of other risk factors shown in Table 1.

On and Off-Pump groups are equivalent in age, ejection fraction and predicted risk of mortality (Table 1).

### Outcomes

- Patients revascularized off-pump had lower operative mortality: 1.9% while patients grafted using CPB had an operative mortality of 18.7% (p=0.003).
- Off-pump patients had a shorter length of stay in hospital, 8.9 ± 7.6 vs 12.0 ± 11.0 days (p = 0.05).
- On-pump patients required significantly more blood product usage (89.9 vs 46.3 %; p < 0.001) and had more cases of prolonged ventilation (30.0 vs 5.6%; p < 0.001).
- Patients grafted using CPB had more anastomoses, 3.3 ± 0.9 vs 2.4 ± 1.0 (p < 0.001).

Table 1: Pre-operative Risk Factors

Variable	Off-Pump Beating Heart		On-Pump Stopped Heart		p-value	
	Count	%	Count	%		
Female	26	48.2	31	34.1	ns	
Current Smoker	11	20.4	14	15.4	ns	
Diabetes	34	63.0	57	63.3	ns	
Controlled by:	Diet	1	2.9	2	3.5	ns
	Insulin	25	73.5	41	71.9	
	Oral	7	20.6	12	21.1	
	None	1	2.9	2	3.5	
Cerebrovascular Accident	8	14.8	11	12.1	ns	
Obstructive Pulmonary Disease	6	11.3	29	31.9	0.008	
Cerebrovascular Disease	11	20.4	16	17.6	ns	
Previous CABG Surgery	4	7.4	4	4.4	ns	
Myocardial Infarction	18	33.3	58	63.7	< 0.001	
MI When:	New MI	7	38.9	20	34.5	ns
	Old MI	11	61.1	38	65.5	
Congestive Heart Failure	17	31.0	41	45.1	ns	
Angina	46	85.2	82	90.1	ns	
Arrhythmia	9	16.7	12	13.2	ns	
# of Diseased Vessels:	One	6	11.1	1	1.1	0.002
	Two	13	24.1	10	11.0	
	Three	35	64.8	80	87.9	
Left Main Disease > 50%	14	25.9	26	28.6	ns	
Preop IABP Use	2	3.6	5	5.6	ns	
<b>Demographics</b>						
Age	61.8 ± 13.4		63.5 ± 11.0		ns	
Ejection Fraction (%)	47.1 ± 15.0		46.9 ± 12.8		ns	
Predicted Risk of Mortality (%)	9.17 ± 7.59		8.99 ± 7.62		ns	

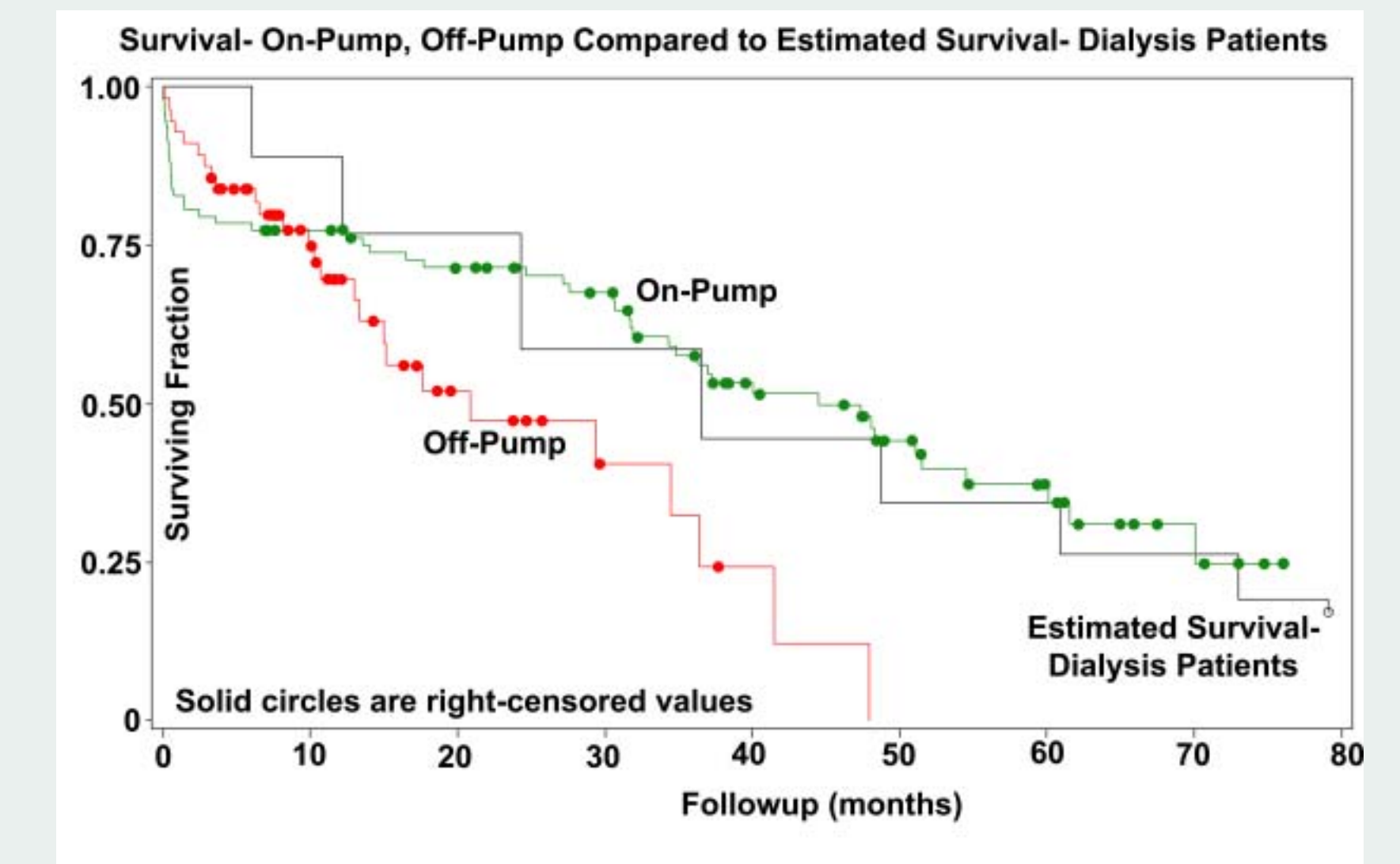
Table 2: Outcomes and Complications

Variable	Off-Pump Beating Heart		On-Pump Stopped Heart		p-value
	Count	%	Count	%	
Operative Mortality	1	1.9	17	18.7	0.003
Re-operation for Bleeding	0	0.0	2	2.2	ns
Myocardial Infarction	0	0.0	0	0.0	ns
Permanent Stroke	0	0.0	2	2.2	ns
Prolonged Ventilation Required	3	5.6	27	30.0	< 0.001
Cardiac Arrest	0	0.0	5	5.5	ns
Post-op Atrial Fibrillation	6	11.1	17	18.7	ns
Blood Products Used	25	46.3	80	89.9	< 0.001
<b>Outcomes</b>					
Length of Stay (days)	8.9 ± 7.6		12.0 ± 11.0		0.05
Total Number Anastomoses	2.4 ± 1.0		3.3 ± 0.9		< 0.001

## Results Cont'd

### Logistic Regression:

- Analysis of mortality data indicates that CPB use is an independent predictor of operative mortality p = 0.02 (Odds Ratio = 12.6, 95% CI: 1.6, 94.0).



### Survival Curves

- Off-pump vs Estimated Survival-Dialysis Patients  
Reduced survival of Off-Pump patients is statistically significant (p < 0.001; log-rank test)
- On-pump vs Estimated Survival-Dialysis Patients  
No significant difference in survival curves (p = ns; log-rank test)
- 50th Percentile Survival  
All ESRD this study 36.4 months (95% C.I. 30.6, 47.4)  
On-Pump only 40.3 months (95% C.I. 31.7, 51.5)  
Off-Pump only 20.9 months (95% C.I. 13.3, 36.4)  
Estimated Survival Dialysis Patients 36.5 months (95% C.I. 24.3, 48.7)

## Conclusions

- Coronary revascularization in ESRD does not appear to improve survival when compared to the historic mortality of 23% per year in dialysis patients (United States Renal Data System).
- Initially, off-pump bypass grafting improves early mortality when compared with conventional revascularization, but this benefit is lost after one year.
- Patients grafted using CPB have more anastomoses done which may indicate more complete revascularization. This may be associated with improved long-term survival.