

Ten-Year All-Cause Mortality Following Coronary Artery Bypass Grafting: A Sex-Stratified Analysis of Revascularization



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Background:

- CABG improves survival in patients with multivessel coronary artery disease, but female patients experience higher short-term mortality (in-hospital and 30-day) compared with males.
- Although females present with greater comorbidity burden (e.g., hypertension, diabetes, heart failure), risk-adjusted analyses suggest these factors do not fully explain sex-based disparities in outcomes.
- Procedural differences may contribute, including lower intraoperative hemoglobin/hematocrit and less frequent use of guideline-concordant revascularization strategies (e.g., LIMA-LAD grafting, multiple arterial grafts, complete revascularization).
- Long-term sex-based outcomes after CABG remain unclear, though evidence from PCI suggests persistent disparities; this study evaluates short- and long-term mortality and the role of complete revascularization.

Study Population:

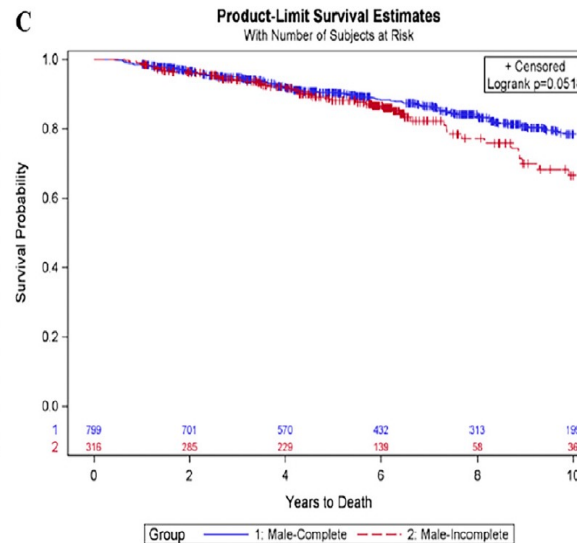
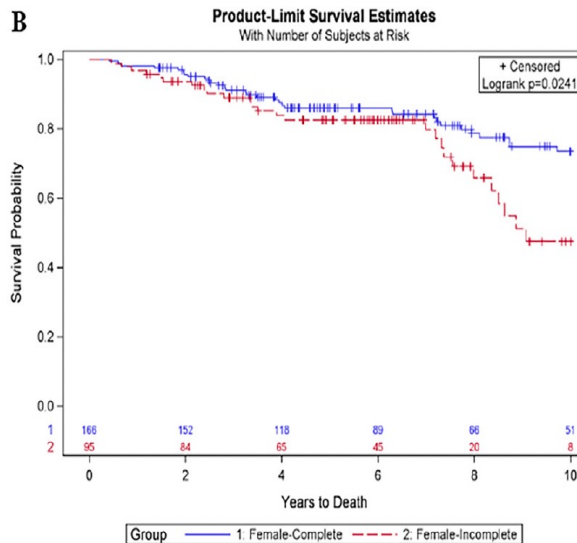
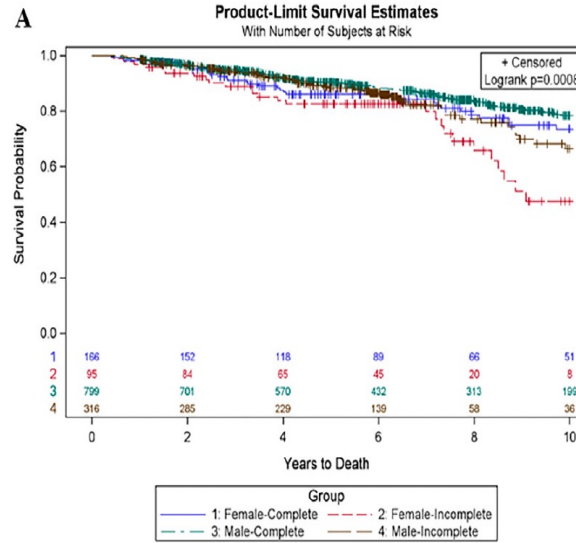
- 1,422 patients: 1150 males (81%) and 272 females (19%)
- Females more likely to present with diabetes, hypertension, lower preoperative hemoglobin, lower intraoperative hemoglobin,
- Females less likely to undergo complete revascularization compared to males (64% v. 71%, $p=0.023$).
- 30-day mortality (1.8% v. 1.5%) and 90-day mortality (4.0% v. 3.0%) equivocal between females and males.
- In a multivariate analysis, incomplete revascularization in female patients was independently associated with 10-year all-cause mortality (HR 1.80 [95%CI 1.02;3.01], $p=0.011$).

Comments:

- Incomplete revascularization drives worse long-term outcomes, with significantly higher 10-year mortality, especially in female patients, where it remains an independent predictor.
- Sex-based divergence emerges over time (~7 years), with poorer survival in females undergoing incomplete revascularization; this may relate to lower use of multiple arterial grafting and differences in operative strategy.
- Patient and perioperative factors also impact survival, including age, lower ejection fraction, diabetes, renal/lung disease, and anemia, with preoperative anemia influencing long-term outcomes, highlighting the importance of optimizing risk factors alongside achieving complete revascularization.
- Persistent sex-based disparities likely reflect multifactorial influences, including anatomic differences (smaller vessels), higher comorbidity burden, delayed diagnosis, and differences in postoperative care (e.g., lower cardiac rehabilitation use in women), underscoring the need for targeted strategies to improve equity in CABG outcomes.

Conclusion:

Female patients are more likely to receive incomplete revascularization, which is strongly associated with worse long-term survival, highlighting the importance of prioritizing complete revascularization to improve outcomes, particularly in female patients.



Influence of baseline variable on all-cause 90-day mortality post-coronary artery bypass grafting.

Variables	Univariable		p-value	Multivariable		p-value
	OR	95%CI		OR	95%CI	
Sex/Vascularization						
Male-Complete	Reference			Reference		
Male-Incomplete	1.896	0.959 - 3.751	0.066	1.836	0.845 - 3.990	0.557
Female-Complete	1.925	0.834 - 4.445	0.125	1.302	0.502 - 3.379	0.587
Female-Incomplete	1.262	0.368 - 4.325	0.712	0.638	0.171 - 2.376	0.503
Age						
Eject Fraction	1.043	1.012 - 1.076	<0.01	1.038	1.005 - 1.073	0.023
Preoperative Hemoglobin	0.962	0.943 - 0.981	<0.0001	0.962	0.941 - 0.984	<0.001
Intraoperative Hemoglobin	0.719	0.631 - 0.819	<0.0001	0.869	0.735 - 1.028	0.102
Chronic Lung Disease						
No	Reference			Reference		
Lung Disease Documented*	1.119	0.262 - 4.774	0.879	0.646	0.137 - 3.037	>0.99
Mild	0.968	0.292 - 3.212	0.958	0.564	0.159 - 2.001	0.968
Moderate/Severe	5.860	2.667 - 12.88	<0.0001	3.427	1.307 - 8.987	>0.99
Peripheral Arterial Disease Status						
Elective	Reference			Reference		
Emergent	6.806	1.920 - 24.13	<0.01	4.873	1.177 - 20.18	0.029
Urgent	3.371	1.486 - 7.645	<0.01	3.192	1.282 - 7.947	0.013

Bold means significant p values at <0.05 level.

CI = confidence interval; OR = odds ratio.

* Lung disease documented, per patients' chart, severity of disease not documented.

Cox regression analysis of all-cause mortality among 90-day survivors following coronary artery bypass grafting during 10 years of follow-up.

Variables	Univariable		p-value	Multivariable		p-value
	HR	95%CI		HR	95%CI	
Sex/Vascularization						
Male-Complete	Reference			Reference		
Male-Incomplete	1.401	1.005 - 1.955	0.047	1.241	0.776 - 1.797	0.223
Female-Complete	1.312	0.887 - 1.942	0.175	1.160	0.793 - 2.472	0.483
Female-Incomplete	2.315	1.510 - 3.549	<0.001	1.797	1.017 - 3.006	0.011
Age						
Eject Fraction	1.042	1.028 - 1.057	<0.0001	1.046	1.021 - 1.057	<0.0001
Preoperative Hemoglobin	0.980	0.971 - 0.988	<0.0001	0.983	0.965 - 0.986	<0.001
Intraoperative Hemoglobin	0.786	0.741 - 0.833	<0.0001	0.891	0.783 - 0.957	<0.01
Diabetes	0.760	0.686 - 0.842	<0.0001	0.989	0.902 - 1.163	0.838
Renal Failure/Dialysis	1.755	1.340 - 2.298	<0.0001	1.353	1.032 - 2.106	0.038
Chronic Lung Disease						
No	Reference			Reference		
Lung Disease Documented*	2.098	1.268 - 3.471	<0.01	1.683	0.971 - 2.882	0.0547
Mild	2.089	1.444 - 3.023	<0.0001	1.672	0.998 - 3.001	<0.01
Moderate/Severe	3.355	2.179 - 5.166	<0.0001	2.844	1.792 - 6.194	<0.001
Cerebrovascular Disease						
Multiple Arterial Grafting (arterial anastomoses ≥ 2)	1.960	1.420 - 2.706	<0.0001	1.583	1.011 - 2.339	<0.01
	0.178	0.057 - 0.557	<0.01	0.310	0.087 - 1.472	0.102

Bold means significant p values at <0.05 level.

CI = confidence interval; HR = hazard ratio.

* Lung disease documented, per patients' chart, severity of disease not documented.