Early SVG Failure

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Abstract

Saphenous vein graft (SVG) is the most common technique of coronary artery bypass grafting (CABG). SVG failure is a source of significant morbidity and mortality and is the bane of the technique. Despite this, SVG was used in up to 85% of CABG cases done worldwide in 2015. There is a large volume of literature on late SVG failure unlike early SVG failure. This manuscript provides further insight to the pathology and prevention of early SVG failure. Early SVG failure is defined as the inability of SVG to support the metabolic requirement of a targeted myocardium resulting in potential ischemia/infarction necessitating an intervention. The major culprits for early SVG failure are vascular endothelial damage and turbulent flow. These generate shear stress and cytokine releases that mediate processes that culminate in early thrombotic SVG occlusion; a substrate for late SVG occlusion. Prevention of early SVG occlusion depends on good surgical techniques, minimal endothelial damage to SVG, large calibre anastomosis, storage in buffered ionic solution and prompt postoperative used of pharmacologic agents like antiplatelet, ACE-inhibitors and statins. Experimental techniques like external SVG vest and gene therapy show promising initial results.

Keywords:
Coronary artery bypass surgery, endothelium, occlusion, platelet, prevention, saphenous vein graft failure, thrombosis, vein graft disease

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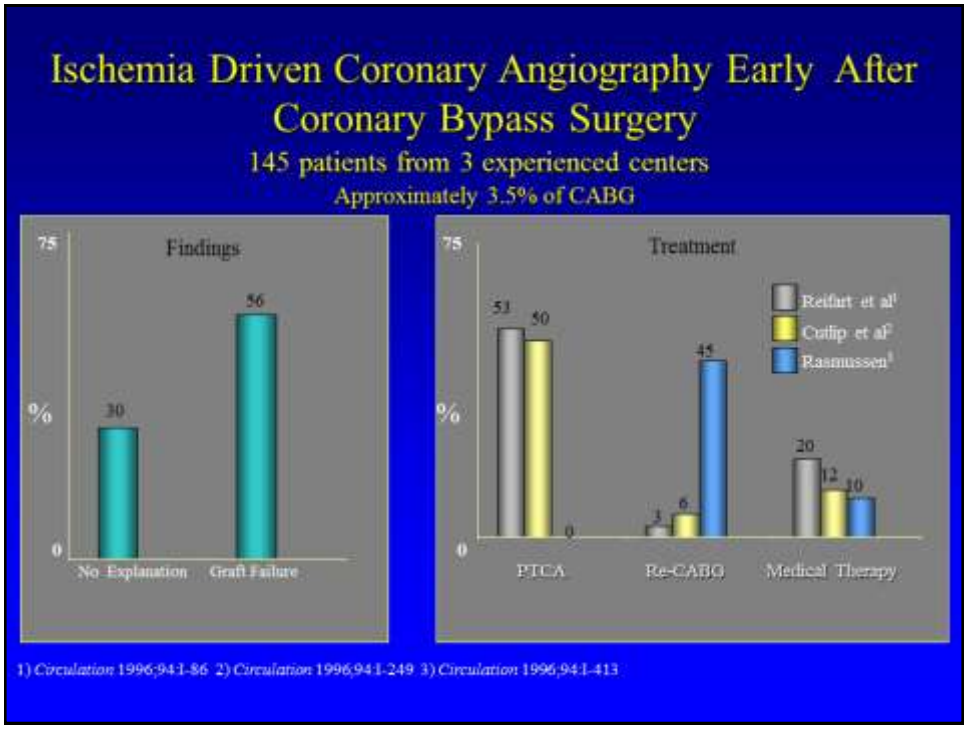

What is the Frequency of Graft Failure at One Year ?

Study	1 Year (% per patient)	5 Years	10 Years
PRAGUE-4	41% (on pump) 51% (off pump)	NA NA	NA NA
PREVENT IV	41.7%	NA	NA
RIGOR	31%	NA	NA
Halabi, et. al.	39.3%	NA	NA
ROOBY	28.7% (on pump) 36.5% (off pump)	NA	NA
Goldman et. al.	20%	31%	39%

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Vanderbilt Intra-operative Angiography After CABG Study

796 Grafts ; 2005-2007

- **97 (12%) had significant defects**
- **22 (2.8%) minor adjustments**
- **48 (6%) required PCI (1.8 stents per pt. ; 84% DES)**
- **27 (3.4%) surgical revision**

Zhao et al *JACC* 2009;53:232

How Should Early Post-CABG Ischemia Be Managed?

Coronary Angiography and PCI (or Re-Op) If Appropriate - Class I indication ACC/AHA PCI

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In Hospital Results of 2,256 Patients After SVG PCI at Emory University Hospital

Angiographic Success	95%
In Lab Complication	12%
CK > 750	7%
Q wave MI	1%
In-Hospital Death	1%

Ashfaq, Ghazzal, Douglas et al *J Invasive Cardiol* 2006;18:100-105

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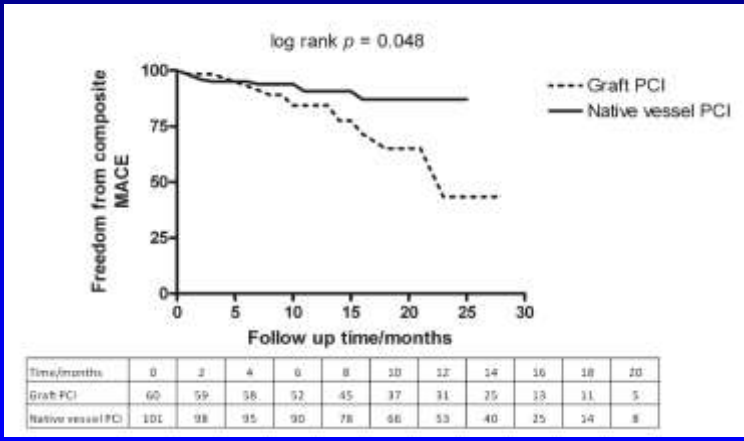
Case 1

- 56 year old male, presenting with ACS, inferior NSTEMI.
- Angio reveals critical proximal RCA disease, and severe left coronary stenosis, (CTO LAD)
- As excellent targets for CABG, referred for emergency CABGx4.
- CABG performed one day later.
- 7 hours post CABG cardiogenic shock and acute STEMI in the inferior leads, ventilation and IABP.

Post-CABG Myocardial Ischemia

Native Vessel vs SVG PCI With Drug-Eluting Stents



Time/months	0	2	4	6	8	10	12	14	16	18	20
Graft PCI	60	59	58	52	45	37	31	25	13	11	5
Native vessel PCI	101	98	95	90	78	66	53	40	25	14	8

Bundhoo et al *CCI* 2011;78:169

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Inside the cath lab and next 24h

- Immediate hemodynamic improvement.
- Weaned off the ventilator and IABP within less than 24h.
- Discharged from the CCU to a room in 3 days.
- Discharged from the hospital with good EF in one week.

13 years later, fully active normal LVEF, asymptomatic, still angry at not receiving a PCI in the first place

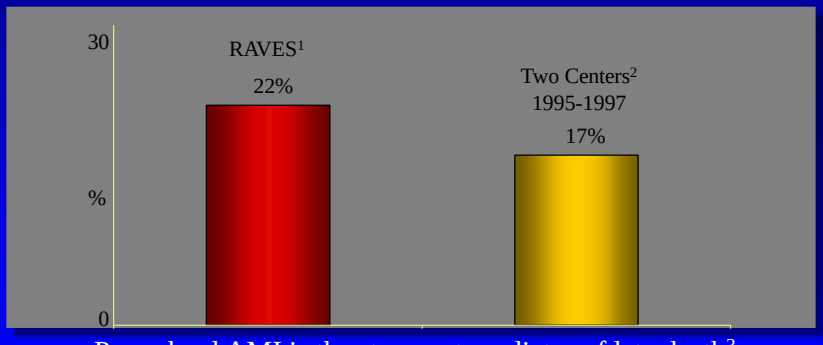
- We are always available as PCI onsite 24/7 backup for early CABG failures, exactly like we used to have on site surgical backup in the early days of PTCA

Case 2

- LIMA to LAD, SVG to RCA
- 6 months post CABG- severe rest angina (ACS) Angio Patent LIMA to LAD, critical proximal SVG to the RCA with a visible intracoronary thrombus.
- PCI performed using Spider Rx distal protection device and 4 /20 mm DES.
- 8 year clinical follow up, asymptomatic, negative stress test.

PCI in SVG Disease is often Complicated by Myocardial Infarction

Creatine Kinase > 3 times normal



Procedural AMI is the strongest predictor of late death[3]

[1] *Circulation* 1996;94:I-683 [2] *Circulation* 1998;98:I-353 [3] *Circulation* 1999;100:2400-2405

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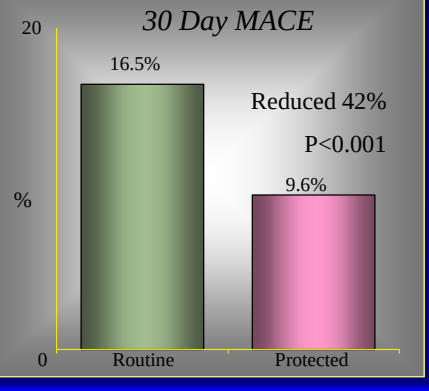
Options For Improved Outcomes in SVG PCI

- **Embolic Protection**
- **Stent Issues (Direct stenting, DES vs BMS, sizing)**
- **Thrombus Management**
- **Vasodilators**

SAFER Trial – Comparison of PercuSurge to Routine Stenting in SVG's

801 Patients Randomized



Baim et al. *Circulation* 2002;105:1285.

FilterWire

Fire Trial: Randomized Filter Wire vs. GuardWire in SVG PCI

650 patients in 65 sites

	FW	GW
TIMI 3 Flow	95.7%	97.7%
Device Success	95.5%	97.2%
Death	0.9%	0.9%
MI	9.0%	10.0%
QMI	0.9%	0.6%
30 day MACE	9.9%	11.6%

Conclusion: FW not inferior to GW

Stone et al. *J Am Coll Cardiol* 2003; 41: 43A

Direct Stenting of SVGs Improves Acute Outcomes

- **Less non-Q MI (11% vs 18% , P<0.02)**
- **Reduced CK-MB**
- **Lower maximal CK-MB**

Leborgne et al *AHJ* 2003;146:501

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Should Stents in SVGs Be Intentionally Undersized ?

- **Less plaque extrusion through stent struts by IVUS**
- **Less MI (CK-MB > 3 X Normal)**
- **Similar TVR and TLR at 1 year**

Hong et al *AJC* 2010 ;105:179

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Conclusions: Post-CABG Revascularization

- **Distal protection devices are useful specially in old grafts**
- **Direct stenting and slightly undersizing may improve outcomes**
- **DES treatment reduces angiographic and clinical restenosis but does not alter death or MI**
- **Native vessel PCI is preferred whenever possible as as an alternative therapy**

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- Surgeons still use SVG's in more than 90% of patients.
- The best way to keep an SVG open is to leave it in the leg.
- Awaiting Data from the NIH HYBRID study

- Thank you