

Mid-term Angiographic Follow-Up After OPCAB



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Is Off-Pump CABG Really Better Than On-Pump CABG?

- Prospective, Randomized Trials
- Large Population Studies
- Literature Reviews / Meta-analyses

Prospective, Randomized Trials of
 OPCAB vs Conventional On-Pump CABG; *Mortality*

Trials	OPCAB		On-Pump CABG	
	#	Mortality	#	Mortality
Van Dijk (NEJM 2003)	139	0	142	0
Angelini (Lancet 2002)	201	2	200	0
Puskas (JTCVS 2003)	99	2	98	1
PRAGUE-4 (ATS 2004)	184	2	204	4
Khan (NEJM 2004)	50	0	54	0
TOTAL	673	6 (0.9%)	698	5 (0.7%)

Prospective, Randomized Trials of
 OPCAB vs Conventional On-Pump CABG; *Stroke*

Trials	OPCAB		On-Pump CABG	
	#	Stroke	#	Stroke
Van Dijk (NEJM 2003)	142	1	139	2
Angelini (Lancet 2002)	200	0	201	0
Puskas (JTCVS 2003)	98	1	99	2
PRAGUE-4 (ATS 2004)	204	0	184	2
Khan (NEJM 2004)	54	?	50	?
TOTAL	698	2 (0.3%)	673	6 (0.9%)

Prospective, Randomized Trials of
OPCAB vs Conventional On-Pump CABG; *Transfusions*

Trials	OPCAB		On-Pump CABG	
	#	Transfusion (%)	#	Transfusion (%)
Van Dijk (NEJM 2003)	142	28	139	29
Angelini (Lancet 2002)	200	18	201	49
Puskas (JTCVS 2003)	98	26	99	44
PRAGUE-4 (ATS 2004)	204	49	184	51
Khan (NEJM 2004)	54	37	50	65
TOTAL	698	31%	698	45%

$p < 0.01$

Prospective, Randomized Trials of
 OPCAB vs Conventional On-Pump CABG; *Atrial Fibrillation*

Trials	OPCAB		On-Pump CABG	
	#	AF (%)	#	AF (%)
Van Dijk (NEJM 2003)	-	-	-	-
Angelini (Lancet 2002)	200	12	201	37
Puskas (JTCVS 2003)	98	16	99	22
PRAGUE-4 (ATS 2004)	204	20	184	24
Khan (NEJM 2004)	-	-	-	-
TOTAL	502	15%	484	29%

$p < 0.01$

New York State CABG Database 1997-2000

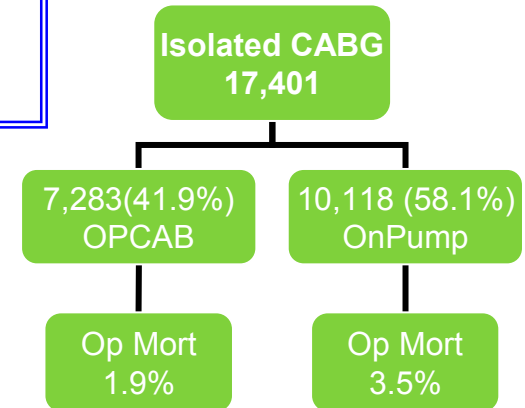
JACC 2004

	OPCAB	On-Pump CABG	<i>p</i>
N	9,135	59,044	
Risk-adjusted Mortality	2.02%	2.16%	0.39
Stroke	1.6%	2.0%	0.003
Reop Bleeding	1.6%	2.2%	<0.001
Hospital stay	5 days	6 days	0.001

Comparison of coronary bypass surgery w/ & w/o cardiopulmonary bypass in patients with MVD.

Mack MJ. JTCVS 2004

4 experienced centers in OPCAB
3-y period

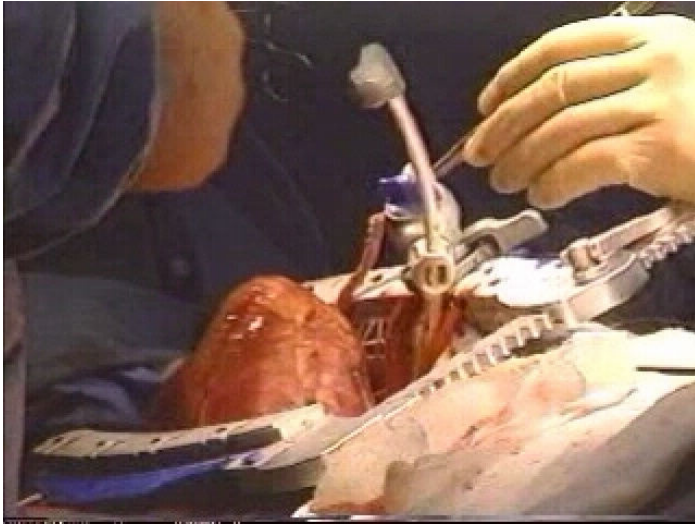


11,548 propensity score matched

CPB risk for mortality (All pts) OR 2.08 CI 1.52-2.83

OPCAB	Less Transfusion	32.6% vs 40.6%	p <0.01
	Stroke	1.4% vs 2.1%	p=0.002
	Renal Failure	2.6% vs 5.2%	p< 0.001
	Pulmonary Comp	4.1% vs 9.5%	p<0.001
	Reop	1.7% vs 3.2%	p<0.001
	AF	21.1% vs 24.9%	p<0.001

Is Off-Pump CABG Really Better Than On-Pump CABG?



Graft Patency?

Early & Mid-term

A randomized comparison of off-pump and on-pump multivessel coronary-artery bypass surgery; 3 mo results

Kahn NE. N Engl J Med 2004;350:21

Table 3. Angiographic Outcomes Three Months Postoperatively.*

Variable	On-Pump Group	Off-Pump Group	P Value	Absolute Difference (95% CI)
Patency rate — no./total no. (%)				
Overall	127/130 (98)	114/130 (88)	0.002	10 (3.8 to 16.2)
Left anterior descending artery	40/40 (100)	35/38 (92)	0.07	8 (−0.1 to 16.5)
Circumflex artery	35/37 (95)	33/38 (87)	0.25	8 (−5.3 to 20.7)
Right coronary artery	35/35 (100)	31/37 (84)	0.01	16 (4.3 to 28.1)
Pediced left internal thoracic artery	47/47 (100)	46/50 (92)	0.05	8 (0.5 to 15.5)
Radial artery	22/22 (100)	26/34 (76)	0.01	24 (9.3 to 37.8)
Saphenous vein	56/59 (95)	40/44 (91)	0.42	4 (−6.1 to 14.2)
Quantitative coronary angiography†				
Reference diameter — mm	2.06±0.40	2.11±0.64	0.65	0.50 (−0.29 to 0.19)
Luminal diameter — mm	1.63±0.68	1.46±0.93	0.37	0.17 (−0.20 to 0.54)
Stenosis — % of reference diameter	21.19±26.38	34.67±34.53	0.06	−13.48 (−27.51 to 0.55)

* Plus-minus values are means ±SD. CI denotes confidence interval.

† Follow-up angiographic data were available for 39 patients in the on-pump group and 43 in the off-pump group.

Clinical and radiologic outcome of OPCAB at 12 mo follow-up:
a prospective randomized trial

Lingaas PS. Ann Thorac Surg 2006;81:2089

Graft Localization	Time Point (mos)	Off-Pump	On-Pump
IMA	00	55/57 (97%)	57/58 ^a (98%)
IMA	0	57/57 (100%)	57/58 ^a (98%)
IMA	3	52/54 (96%)	58/59 (98%)
IMA	12	48/51 (94%)	54/56 (96%)
Vein grafts total	00	87/91 (96%)	100/102 (98%)
Vein grafts total	0	88/91 (97%)	100/102 (98%)
Vein grafts total	3	72/86 (84%)	95/104 (91%)
Vein grafts total	12	67/84 (80%)	84/97 (87%)

Early randomized comparison of off-pump and on-pump multiple arterial coronary revascularization

Kobayashi J. Circulation 2005;112[suppl 1]:I-338

TABLE 5. Early Graft Patency Without Stenosis According to Graft Material and Sites

	Off-Pump	On-Pump	P Value
Graft material			
ITA	116/125 (93)	135/144 (94)	0.81
Radial artery	110/116 (95)	128/129 (99)	0.055
Composite	56/59 (95)	69/72 (96)	>0.99
GEA	19/22 (86)	22/23 (96)	0.34
Saphenous vein	16/17 (94%)	9/9 (100)	0.99
Bypass sites			
LAD area	118/125 (94)	124/129 (96)	>0.99
Circumflex area	83/88 (94)	98/103 (95)	>0.99
RCA area	60/67 (90)	72/73 (99)	0.028
GEA	18/21 (86)	19/19 (100)	0.23
Total	261/280 (93)	294/305 (96)	0.093

Values are expressed as n/N (%).

Mid-term Angiographic Follow-Up After OPCAB:

Serial Comparison Using Early, 1-year, & 5-year Postoperative Angiographies



김기봉, 이해영, 강현재, 구본권, 김효수, 손대원, 오병희, 박영배

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Patients & Methods (1)

- Jan. 1998 ~ Dec. 2001
- 240 (59.7%) of 402 OPCAB pts
 - Received early, 1-y, & 5-y angiographies, regardless of anginal symptoms
 - Exclusion criteria for anigographic follow-up :
 - pts who died, refused angiographic evaluation, or had renal function impairment*

Patients & Methods (2)

- Coronary angiographies
 - *Early postoperative (Postop D 1.6 ±1.6)*
 - *1-y (Postop Mo 13.2 ± 5.2)*
 - *5-y (Postop Mo 59.9 ± 5.7)*
- Retrospective coronary angiographic review
- FitzGibbon grading system
- Single surgeon in a single center

FitzGibbon Grading System

FitzGibbon et al. Circulation 1978;57:1070

- **Grade A:** an excellent graft w/ unimpaired run-off
- **Grade B:** > 50% stenosis at the anastomosis or trunk

Grade A + B : patent

- **Grade O:** occlusion

* **Grade B : Competitive graft flow ;** *distal graft as well as distal native grafted coronary artery flow not clearly opacified as seen by graft angiography, but well-visualized graft retrogradely as seen by native coronary angiography*

Aims of This Study

- Serial comparison of the graft patency rates in pts who had received angiographies early postoperatively, 1 y & 5 y after OPCAB
- Evaluation of the graft patency rates based on target territories & revascularization strategies during the 5 postoperative years
- Assessment of the serial changes of FitzGibbon B stenotic grafts during the 5 postoperative years

Preop Characteristics & Risk Factors (I)

Patient Characteristics	N = 240
Sex (M / F)	158 / 82
Age (y)	61 ± 9
Unstable / stable angina	191 / 49
Angiographic diagnosis	
3-vessel disease	148 (61.7%)
2-vessel disease	57 (23.8%)
Left main disease w/ or w/o peripheral disease	64 (26.7%)

Preop Characteristics & Risk Factors (II)

Risk factors	N = 240
Hypertension	144 (60.0%)
Diabetes mellitus	83 (34.6%)
Hyperlipidemia	63 (26.3%)
History of Stroke	27 (11.3%)
LVEF <35%	13 (5.4%)
Chronic renal failure	5 (2.1%)
Urgent / emergent	33 (13.8%)

Operation

- ❑ A standard skeletonizing technique for harvesting the ITA & RGEA
- ❑ Anticoagulation ; Heparin : 1.5 mg/kg
ACT during OPCAB : > 300 sec
Protamine reversal ; none
- ❑ Halted aspirin (300mg/d) the day before surgery & resumed it one day postoperatively

Grafts & Their Target Coronary Arteries

Graft	LAD	D	RI	OM	RCA	PDA	PLB	Total
ITA	222	100	29	141	17	15	3	527
Left ITA	148	74	17	69			1	309
Right ITA	74	26	12	72	17	15	2	218
RGEA				6	13	59	2	80
RA	1	2	1	4			1	9
SV	7	23	6	43	20	19	3	121
Total	230	125	36	194	50	93	9	737

Results



Serial Angiographic Patency Rates

	Early	1-y	5-y
ITA	99.4% (524/527)	95.6% (504/527) ^a	92.4% (487/527) ^b
Left ITA	99.4% (307/309)	95.5% (295/309) ^a	91.9% (284/309) ^d
Right ITA	99.5% (217/218)	95.9% (209/218) ^c	93.1% (203/218) ^d
RGEA	97.5% (78/80)	91.3% (73/80)	82.5% (66/80) ^d
Radial artery	100% (9/9)	88.9% (8/9)	88.9% (8/9)
Saphenous vein	95.9% (116/121)	76.0% (92/121) ^a	74.4% (90/121)
Total	98.6% (727/737)	91.9% (677/737) ^a	88.3% (651/737) ^b

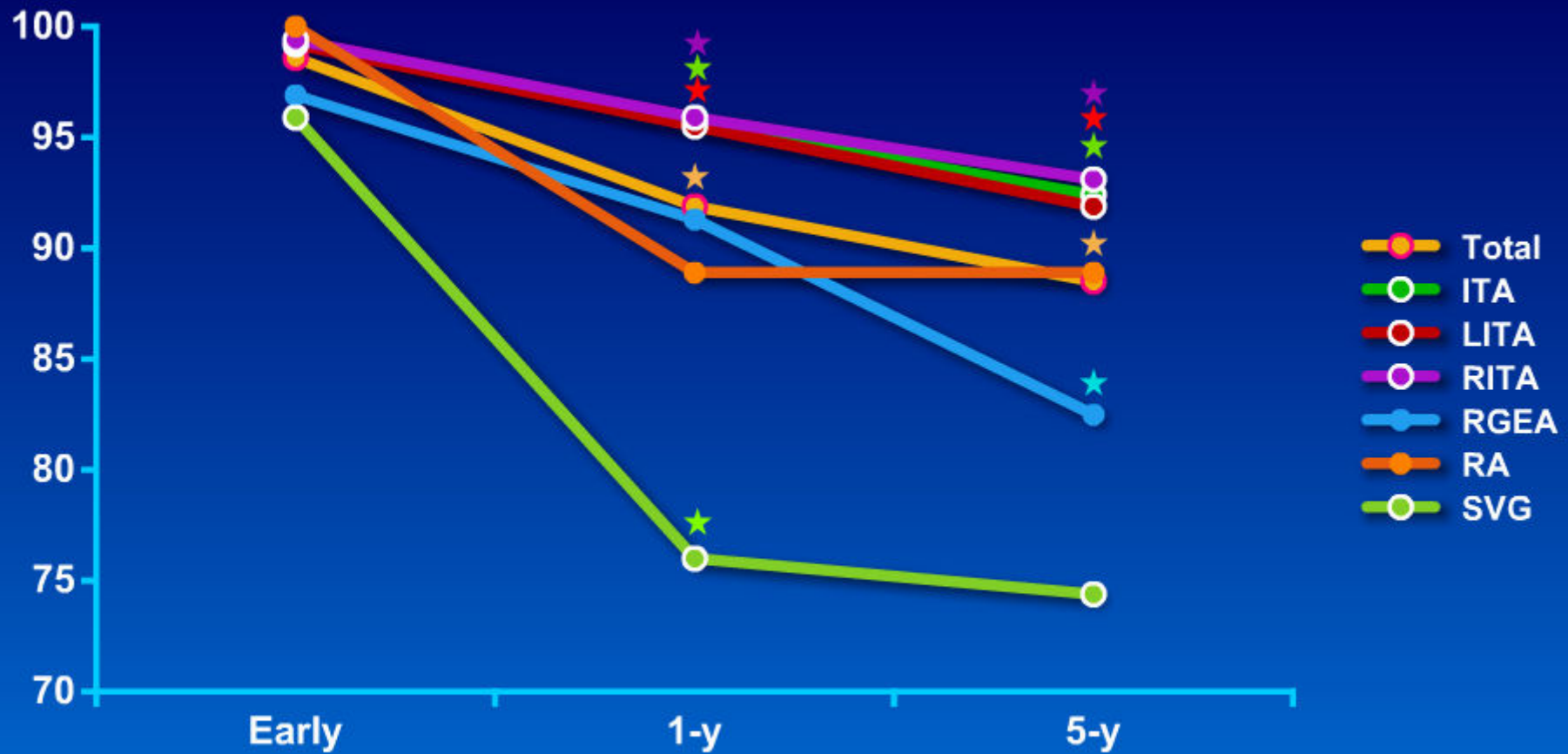
^a $p < 0.001$ between early & 1-y ;

^c $p < 0.05$ between early & 1-y;

^b $p < 0.001$ between 1-y & 5-y

^d $p < 0.05$ between 1-y & 5-y

Serial Angiographic Patency Rates



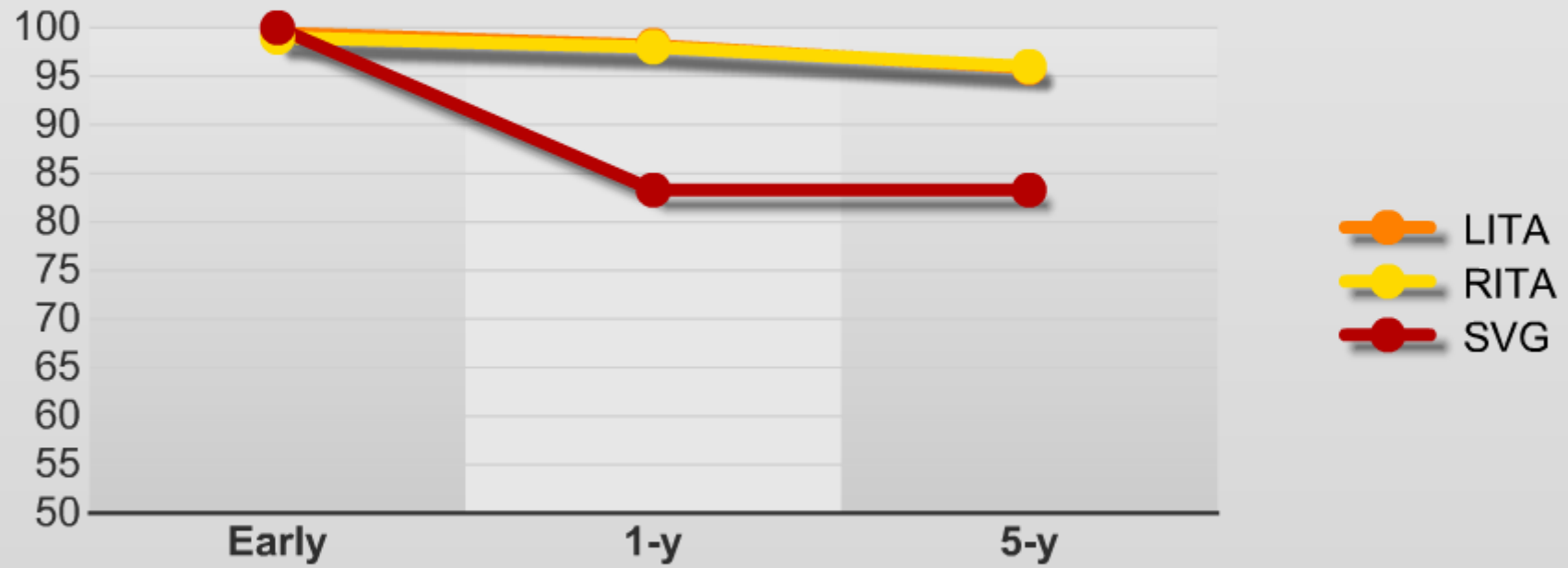
Serial changes of graft patency rates according to target coronary artery territories

Overall Graft Patency Rates

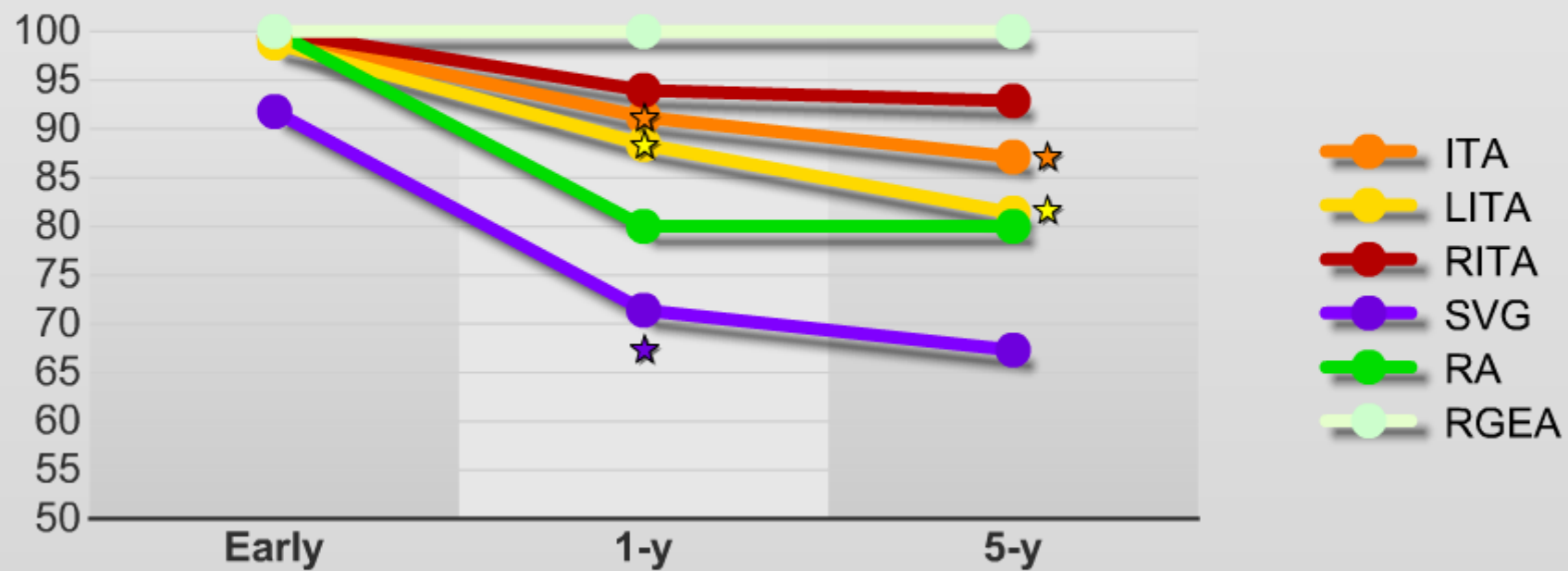
	LAD territory	LCX territory	RCA territory
Early	99.4% (353/355)	97.8% (225/230)	98.0% (149/152)
1-y	96.9% (344/355)	87.8% (202/230) [★]	86.2% (131/152) [★]
5-y	94.9% (337/355)	83.0% (191/230) [★]	80.9% (123/152) [★]

★ $p < 0.001$ when compared w/ LAD territory

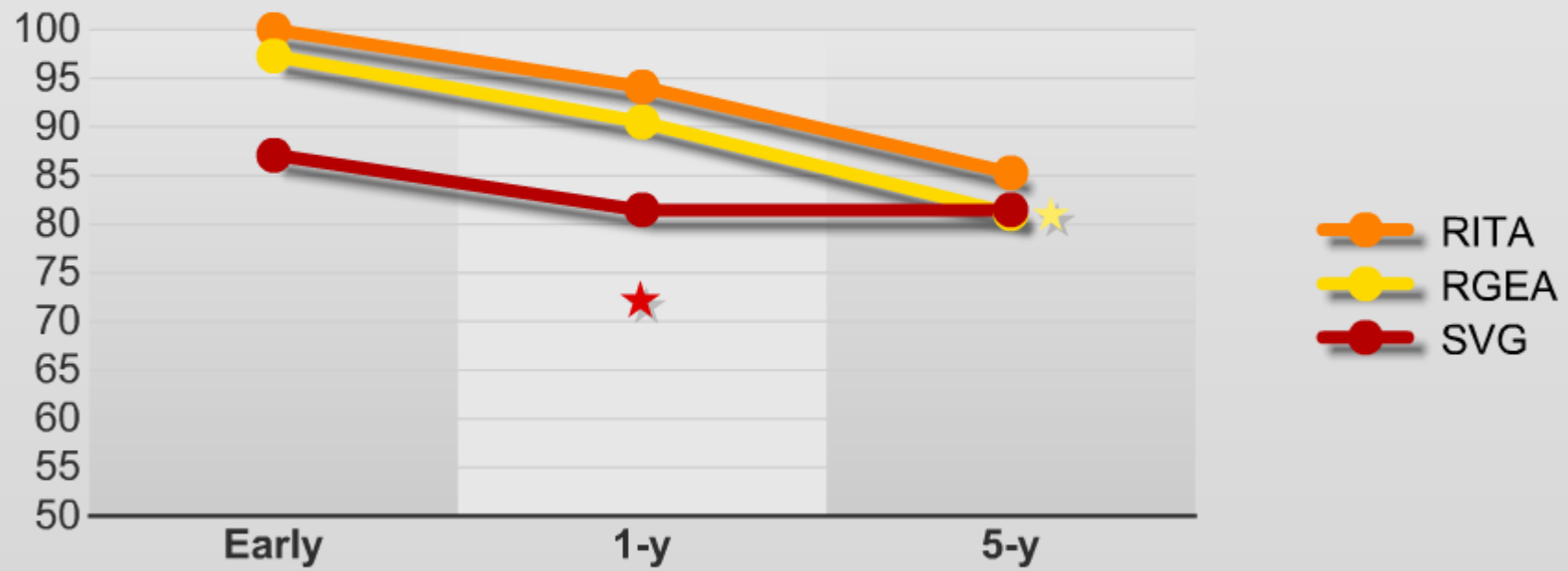
LAD territory



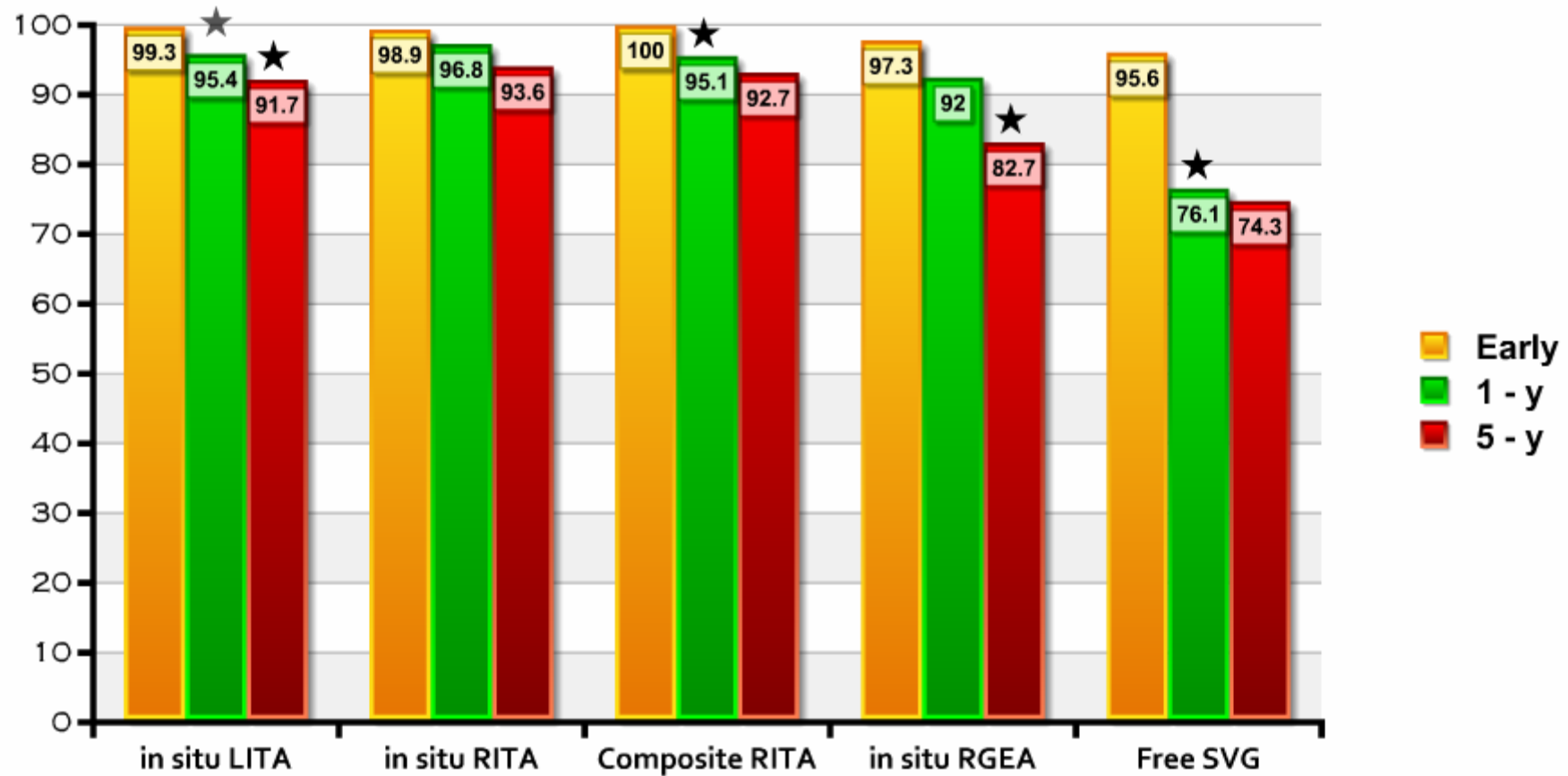
LCX territory



RCA territory



Changes of the Graft Patency According to Proximal Techniques



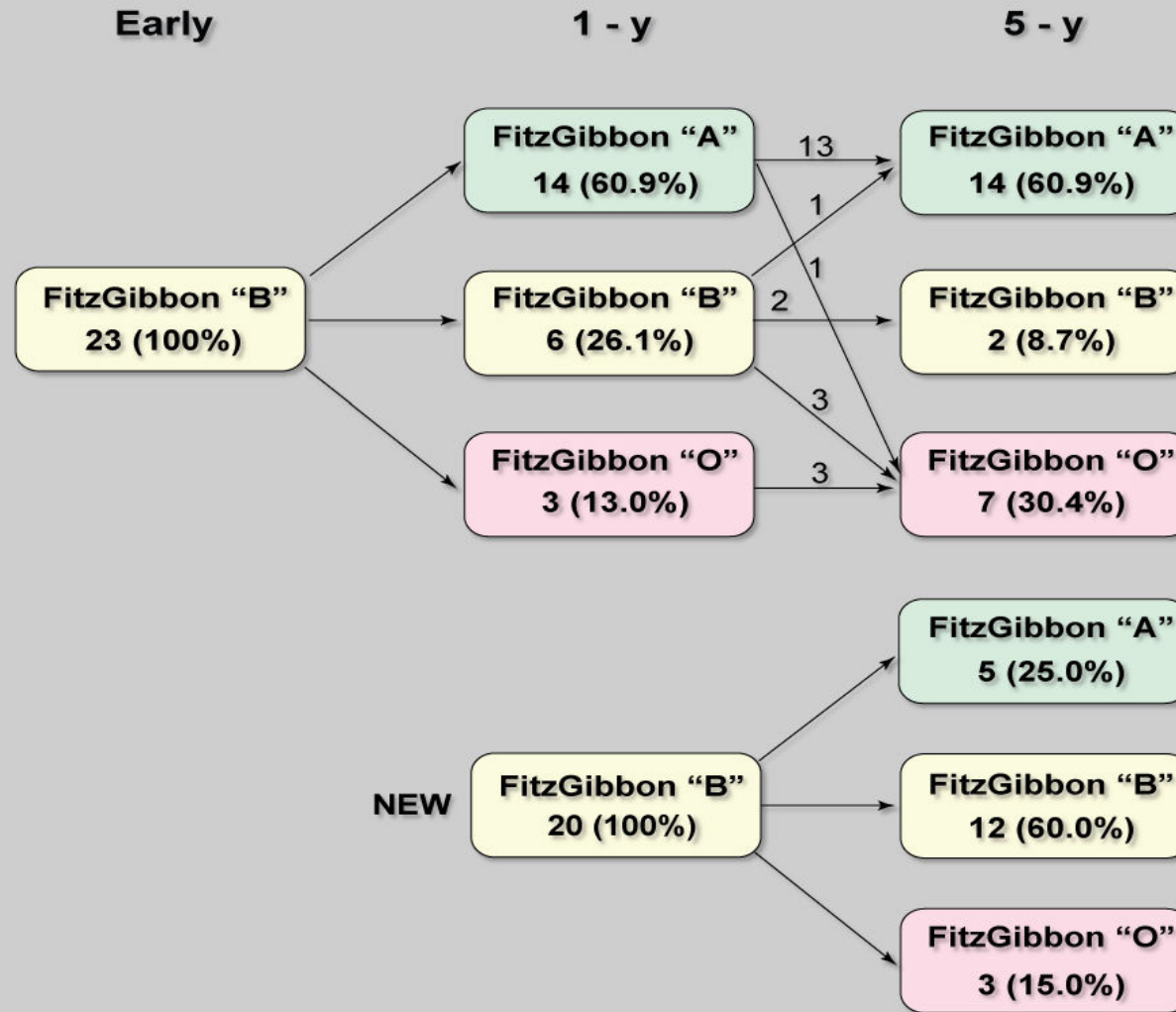
Fates of FitzGibbon Grade B Lesions

	Early	1-y	5- y
Arterial Grafts	5.1% (31/602)	5.5% (32/577)	6.0% (33/553)
ITA	4.4% (23/524)	5.2% (26/504)	6.0% (29/487)
RGEA	10.3% (8/78)	8.2% (6/73)	6.1% (4/66)
Saphenous vein	2.6% (3/116)	6.5% (6/92)	13.3% (12/90) ^a

^a $p < 0.01$ between early & 5-y

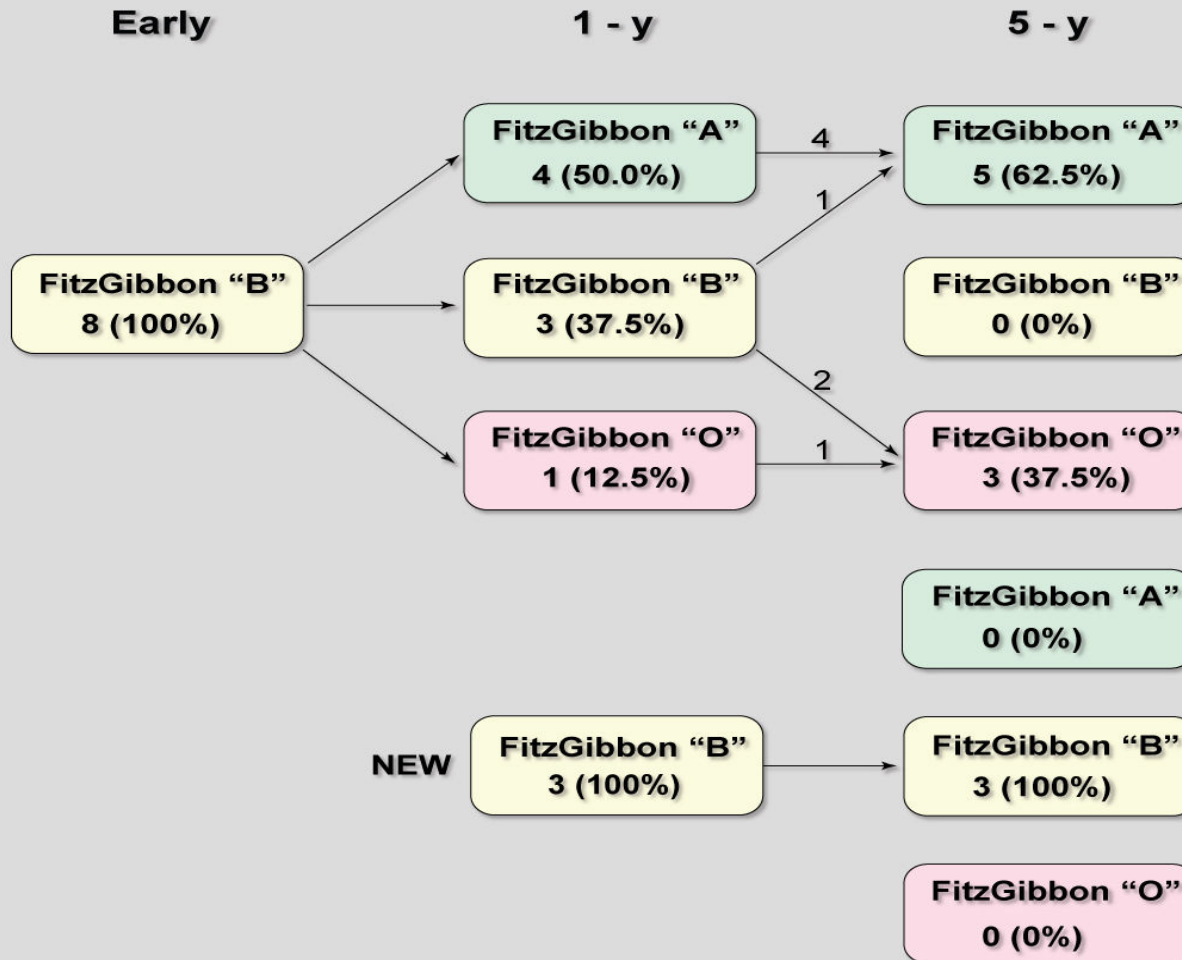
Fates of FitzGibbon Grade B lesions

- Internal thoracic artery-



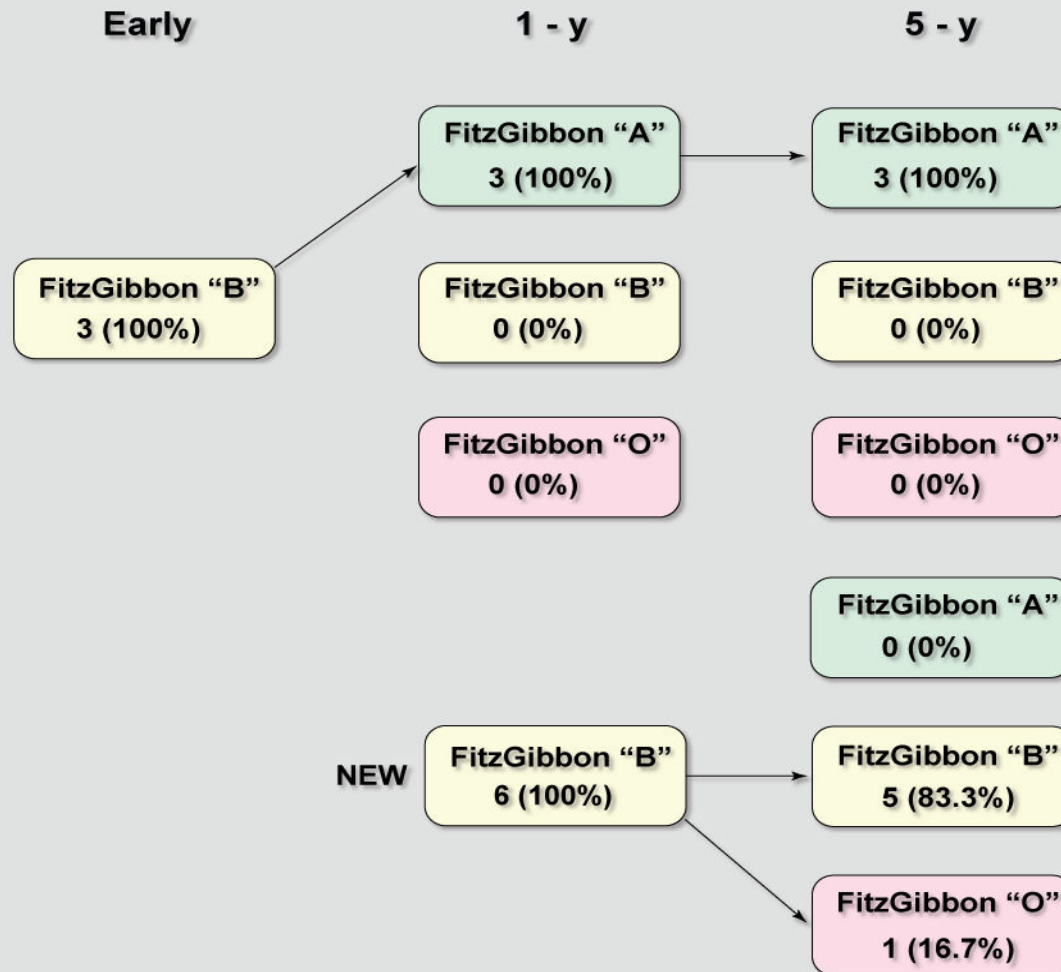
Fates of FitzGibbon Grade B lesions

- Right gastroepiploic artery-



Fates of FitzGibbon Grade B lesions

- Saphenous vein-



Recurrence of Angina & Target Vessel Revascularization

1st postop year

Between 1-y & 5-y

Angina Recurrence

10 / 240 (4.2%)

31 / 240 (12.9%)

Graft-related

6 / 240 (2.5%)

18 / 240 (7.5%)

Progression

4 / 240 (1.7%)

13 / 240 (5.4%)

Treatment

- TVR 4
(PCI 3, Reop 1)
- Non-TVR 2 (PCI 2)
- Medications 4

- TVR 10
(PCI 9, Reop 1)
- Non-TVR 7 (PCI 7)
- Medications 14

Graft Patency Rates

OPCAB vs conventional CABG

<i>Graft</i>	<i>Time</i>	<i>OPCAB (n = 240)</i>	<i>Conv- CABG (n = 109)</i>	<i>P-VALUE</i>
ITA	1-Y	504/527(95.6)	141/144(97.9)	0.328
	5-Y	487/527(92.4)	130/144(90.3)	0.489
SVG	1-Y	92/121(76.0)	187/227(82.4)	0.161
	5-Y	90/121(74.4)	182/227(80.2)	0.222

Conclusions

- Mid-term angiographic follow-up demonstrated acceptable patency rates of grafts after OPCAB.
- The LAD territory showed significantly higher overall patency rates than the LCX and RCA territories in both 1-y & 5-y angiographies.
- Approximately half of the FitzGibbon grade B arterial grafts in the early angiography became grade A at 5-y after surgery.
- The proportion of grade B vein grafts gradually increased over the 5 postoperative years.



Thank You for Your Attention!