Off Pump’ta Gelinen Nokta

Prof. Dr. Hayati Özkan

GAZİANTEP ÜNİVERSİTESİ
KALP DAMAR CERRAHİSİ GÜNLERİ
19-21 MAYIS 2006

OPCAB ESKİ BİR YÖNTEMDİR

OPCAB
ASLINDA YENİ BİR YÖNTEM DEĞİLDİR

CPB
John H. Gibbon Philadelphia 06 Mayıs 1953

Murray ve Longmire 1952 safen ima by pass
Demikhov 1952 köpekte by pass
Sabiston 1962 safen sağ koroner by pass
Kolesov 1964 İMA-OM by pass

OPCAB GELİŞİMİ

ANGELİNİ

CALAFİORE

SALERNO

WESTABY

SUBRAMANİAN

ASCİONE

BENETTİ

OPCAB 1998 JANSEN OCTOPUS

NEDEN CABG?

HAREKETSİZ ALANDA ANASTOMOZ
KANSIZ ALANDA ANASTOMOZ
BOŞ VE DURAN KALPTE İYİ EKSPOJUR
HEMODİNAMİK STABİLİTE
YETERLİ ZAMAN ?
DENEYİM

TAM REVASKÜLARİZASYON
KALİTELİ DİSTAL ANASTOMOZ

CABG
SORUNLAR
VARMIDIR ?

SİSTEMİK İNFLAMATUVAR YANIT

KOAGÜLOPATİ

SIVI RETANSİYONU

PULMONER DİSFONKSİYON

İNME

NÖROKOGNİTİF DEĞİŞİKLİKLER

MİYOKARD DEPRESYONU

KAN KAYBI

UZUN YATIŞ

NEDEN OPCAB ?

KAN KAYBI AZ

YATIŞ KISA

SİST. ENFL. YANIT YOK-AZ

NÖROKOGNİTİF DİSFONK.- AZ

İNME AZ?

PULMONER DİSFONK. AZ

MİYOKARD DEPRESYONU AZ

AMELİYAT SÜRESİ KISA

BASİT VE UCUZ

NEDEN OPCAB DEĞİL ?

DENEYİM?

İNKOMPLET REVASKÜLARİZASYON ?

SUBOPTİMAL ANASTOMOZ ?

GEÇİCİ İSKEMİ ?

ÖZEL EKİPMAN

ÖZEL EĞİTİM

HEMODİNAMİK İNSTABİLİTE

OPCAB
TEKNİK

OPCAB %20 -30-70-90

MEDİAN STERNOTOMİ

VERTİKAL POZİSYON

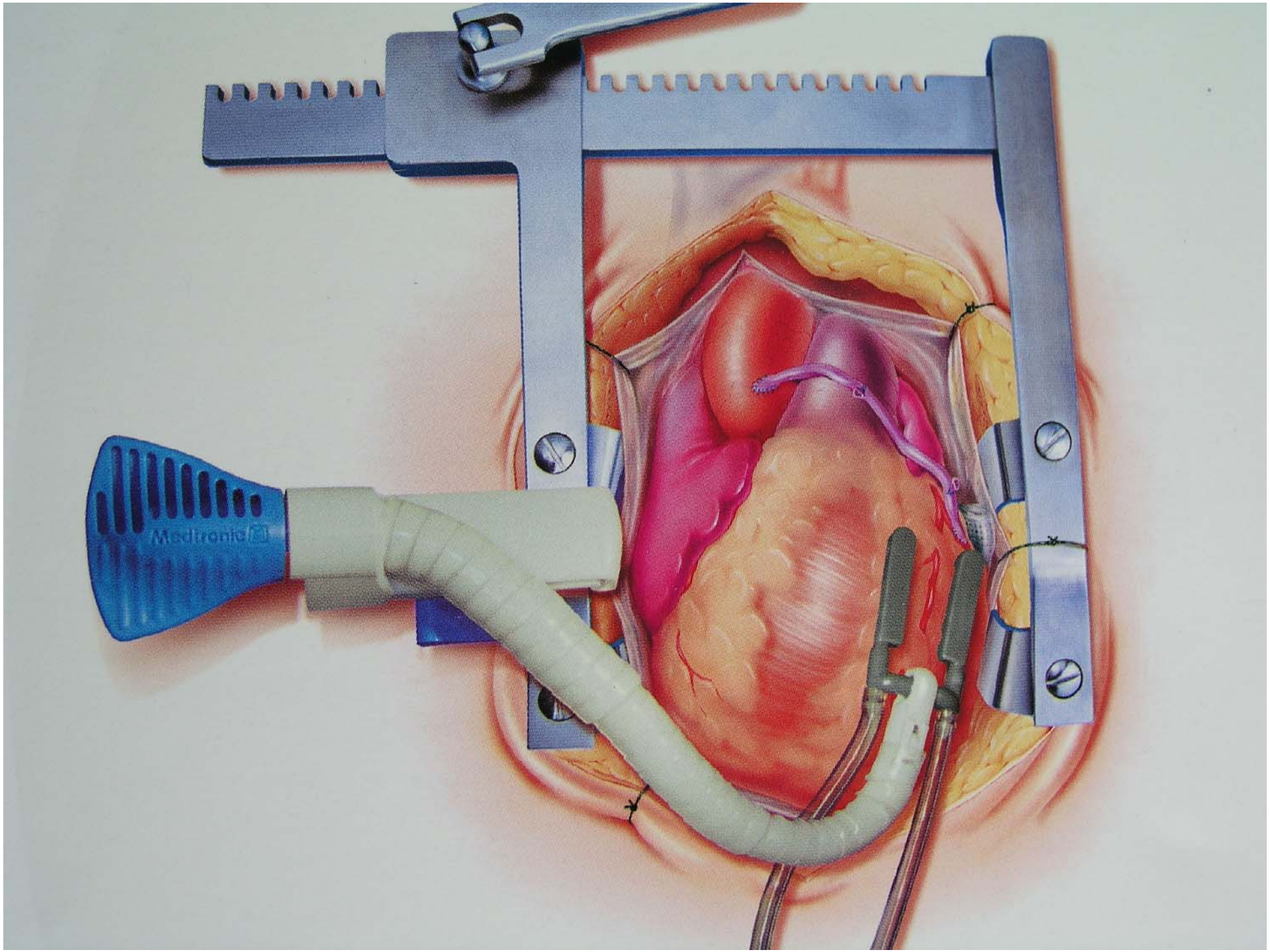
OCTOPUS-STARFİSH

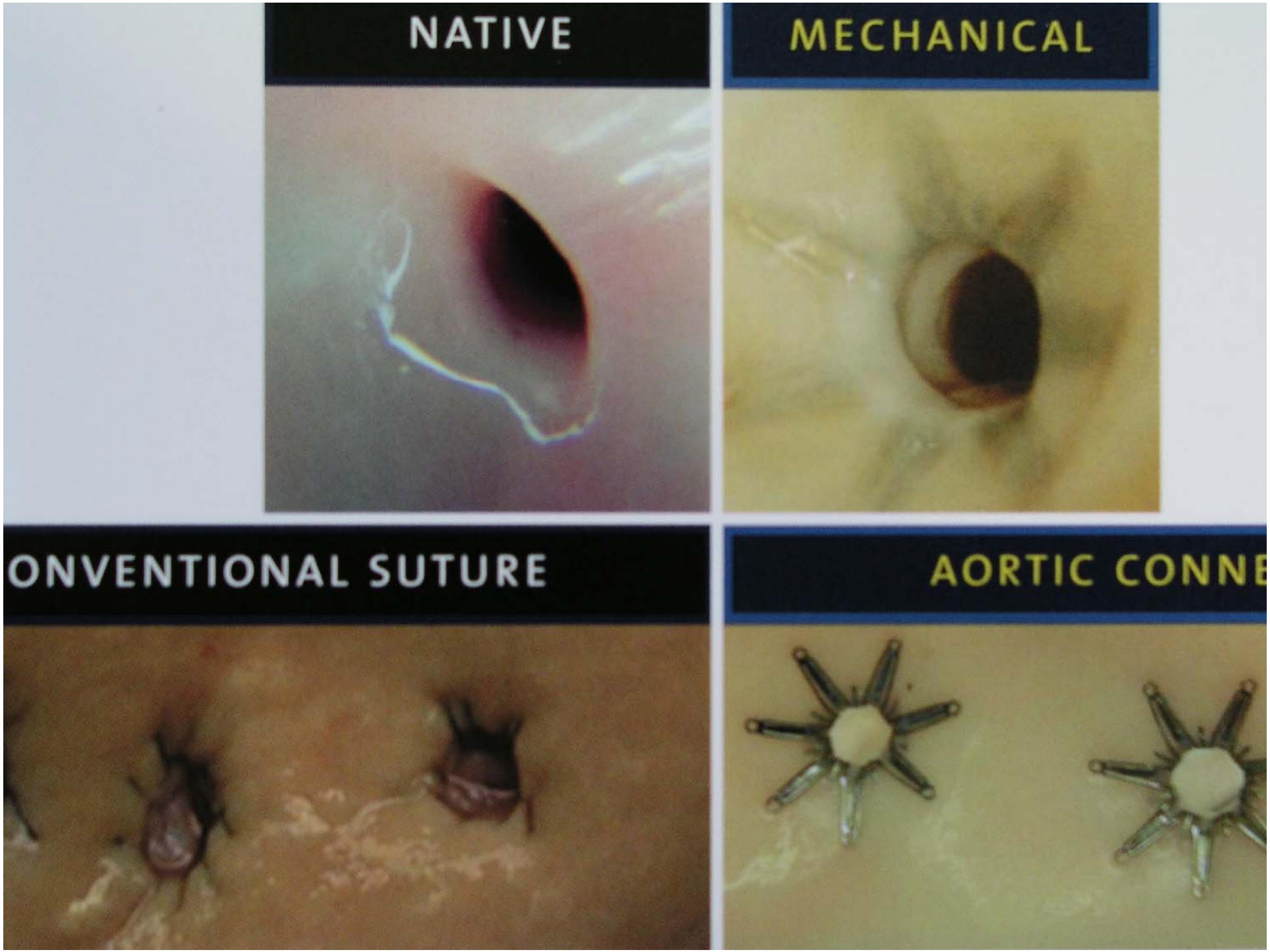
TOTAL REVASKÜLARİZASYON

PROKSİMAL SİDE KLEMP

HAVA-SIVI ÜFLEME

KORONERE PROKSİMAL BULL-DOG


Medtronic


NATIVE
MECHANICAL
ONVENTIONAL SUTURE
AORTIC CONNE

OPCAB
GEREKSİNİM

ANESTEZİST

PERFÜZYONİST

DOPAMİN-ADRENALİN-ANTİARİTMİK

PACE,İABP

POTASYUM, MAGNEZYUM

TA, SİSTOLİK 90-110 mm Hg

ACT 200-300

SWAN GANZ KATETERİ ?

SİSTEMİK İNFLAMATUVAR YANIT

KANIN YABANCI YÜZEYE TEMASI

KROS KLEMP

REPERFÜZYON

HİPOTERMİ

STERNOTOMİ ?

CERRAHİ STRES ?

SIRS

KOMPLEMAN

İNTERLÖKİN

MAKROFAJ

NÖTROFİL

SİTOKİN

MONOSİT

CABG DE AKTİVE OLUR

SIRS

İL 6-8-10 ARTIŞI

NÖTROFİL AKTİVASYONU

MONOSİT AKTİVASYONU

KOMPLEMAN 3a,5a ARTIŞI

BETA TROMBOGLOBİN ARTIŞI

PROKALSİTONİN ARTIŞI

OPCAB DE OLMAZ

Sistemik inflamatuvar yanıt

Study	Intervention (*n* per group)	Main Result
Aydin et al,116 2005	CABG with CPB (15) versus OPCAB (15)	Endotoxin and lactate levels lower in OPCAB ($p < 0.05$) except after sternotomy.
Jemielity et al,117 2005	CABG with CPB (25) versus OPCAB (25)	IL-6 peak level lower in OPCAB (106.8 ± 60.9 pg/mL v 276.2 ± 161.0 pg/mL; $p < 0.05$); CRP higher in CABG at 24 h(66.6 ± 35.5 mg/L v 41.0 ± 22.8 mg/L; $p < 0.01$); AGP rise comparable.
Schulze et al,118 2000	CABG with CPB (13) versus OPCAB (13)	Significant increase in the TNF system and sIL-2r in CABG; no difference in IL-6 levels; CRP and total nitrate/nitrite levels significantly lower in OPCAB.
Ascione et al,119 2000	CABG with CPB (30) versus OPCAB (30)	Neutrophil elastase ($p < 0.0001$), IL-8 levels ($p = 0.01$), WBC counts ($p < 0.01$) and incidence of postoperative infection ($p < 0.0001$) higher in CABG.
Diegeler et al,113* 2000	Full sternotomy CABG with CPB (10), full sternotomy OPCAB (10), limited LAT OPCAB (10)	A significant increased release of C3d, C5a, IL-8 IL-10, and TNF-α receptors p55 and p75 after CABG.
Matata et al,110 2000	OPCAB (10) versus CABG with CPB	Significant increase in lipid H_2O_2 (190% at 4 hours), protein carbonyls (250% at 0.5 hrs) & nitrotyrosine (510% at 0.5 hrs), IL-8, elastase, C3a & sE-selectin in CABG.
Gu et al,114 1998	CABG with CPB (31) versus MIDCAB (31)	Leukocyte elastase, platelet beta-thromboglobulin, and C3a levels significantly increased in CABG.

Nörölojik defisit

Study	Intervention (n per group)	Main Result
Keizer et al,149 2003	36 CABG and 45 OPCAB	No difference between OPCAB and CABG (total score, p = 0.458; worry score, p = 0.563) CFQ response.
Lee et al,150 2003	30 CABG and 30 OPCAB	More cerebral microemboli (575 ± 278.5 v 16.0 ± 19.5) and significantly reduced cerebral perfusion (p < OR = 0.01) after CABG.
Zamvar et al,151 2003	30 CABG and 30 OPCAB	Neurocognitive impairment at 7 days (p = 0.004), 10 weeks (p = 0.019); postoperative NSE levels at 2 hours (p < 0.001), 24 hours (p = 0.005) and intraoperative S100 levels (p = 0.002) high after CABG.
van Dijk et al,152 2002	139 CABG and 142 OP-CAB	Similar quality of life, stroke rate, and all-cause mortality.
Diegeler et al,153 2000	20 CABG and 20 OPCAB	Increased HITS (median 394.5, range 0-2217 v 11, 0-50; p < 0.0001) and neurocognitive impairment (90% v 0%) in CABG patients.
Lloyd et al,154 2000	30 CABG and 30 OPCAB	No major neurologic complications or neurologic deterioration in either group.

İnme

Study	Design	Number of Patients		Incidence of stroke		*p* Value
		CABG	OPCAB	CABG	OPCAB	
Sharony et al,155* 2003	Case control	211	211	4.7%	2.4%	0.08
Munerette et al,156 2003	RCT	88	88	2.2%	0%	NS
Grossi et al,157 2003	Retrospective	678	235	6.3%	2.1%	0.01
Schmitz et al,158 2003	Case control	126	125	2.3%	0%	NS
Jarvinen et al,159 2003	Prospective*	1016	115	2.5%	0.9%	0.3
Al-Ruzzeh et al,160 2003	Retrospective	1112	286	1.3%	0%	NS
Novick et al,161 2002	Retrospective	208	112	2.9%	2.4%	0.09
Lev-Ran et al,162 2002	Retrospective	15	41	20%†	0%	0.0164
Potger et al,163 2002	Retrospective	475	407	1.9%	0.2%	< 0.05
Meharwal et al,164 2002	Prospective‡	2312	1075	1.1%	0.6%	0.196
Ishida et al,165 2002	Retrospective	63	95	6.4%	0%	0.013
Zamvar et al,166 2002	Retrospective	247	120	3.66%	1.66%	NS
Anyanwu et al,167 2002	Retrospective	355	286	1%	<1%	NS
Stamou et al,168 2002	Retrospective§	8069	2320	2.5%	1.2%	<0.01

ARDS

Study	Design	Number of Patients	Incidence of ARDS	Mortality of ARDS
Fowler et al.,169 1983	Prospective	237	4/237 (1.7%)	2/4 (50%)
Messent et al.170 1992	Retrospective	840	11/840 (1.3%)	6/11 (55%)
Christenson et al,171 1996	Retrospective	3,848	38/3,848 (1.0%)	26/38 (68.4%)
Asimakopoulos et al.172 1999	Retrospective	2,464	12/2,464 (0.5%)	11/12 (91.6%)

PULMONER FONKSİYON

Study	Intervention (n per group)	Main Result
Cimen et al,181 2003	18 CABG and 18 OPCAB	Pulmonary functions and ABGs not improved in OPCAB.
Roosens et al,182 2002	10 CABG and 13 OPCAB	Similar static and dynamic elastance, work of breathing and PaO_2/F_IO_2.
Kilger et al,183 2001	53 CABG and 52 OPCAB	Significant reduction in adverse events, TISS score, LOS in OPCAB.
Covino et al,189 2001	37 patients with obstructive and/or restrictive pulmonary disease 16 CABG and 37 OPCAB	Shorter duration of operation, ($p < 0.014$), ventilation ($p = 0.003$), LOS ($p = 0.01$), less bleeding ($p = 0.046$), better postoperative RCC, Hb level, and hematocrit after OPCAB.
Guler et al,75 2001	58 patients with severe COPD 18 CABG, 19 OPCAB & 21 MIDCAB	Longer duration of stay, extubation time and lower FEV_1 ($p < 0.05$) in second postoperative month in CABG patients.
Kochamba et al,176 2000	29 CABG and 29 OPCAB	Better postoperative pulmonary shunt in OPCAB ($p = 0.03$).
Cox et al,184 2000	26 CABG and 26 OPCAB	Similar degree of pulmonary dysfunction.

MİYOKARD KORUMASI

Study	Intervention (n per group)	Main Result
Masuda et al,197 2002	29 OPCAB and 189 CABG	Myocardial enzyme leakage was significantly less in OPCAB.
Bennetts et al,198 2002	27 OPCAB and 27 CABG	TnT release was significantly less in OPCAB at 2, 4, 6, 8, 10, 12 and 24 hours posteperative ($p = 0.01$, $p = 0.03$, $p = 0.02$, $p = 0.02$, $p = 0.03$, $p < 0.001$, and $p = 0.03$).
Czerny et al,199 2001	40 OPCAB and 40 CABG	Clinical and hospital outcomes were comparable between the 2 group with no deaths or new MI. Three OPCAB patients had successful PTCA.
van Dijk et al,140 2001	142 OPCAB and 139 CABG	Release of CK-MB was 41% less in OPCAB ($p < 0.01$). In both groups, 4% patients had recurrent angina. Survival free of CV events was 93% OPCAB and 94.2% CABG ($p = 0.06$).
Pentillä et al,196 2001	11 OPCAB and 11 CABG	Maximum myocardial lactate production ($p = 0.02$), transcardiac pH difference ($p = 0.007$), peak posteperative CK-MB mass ($p < 0.001$) and Tn I ($p = 0.008$) high in CABG.
Ascione et al,193 1999	40 OPCAB and 40 CABG	No deaths or intraoperative MI in either group. TnI release constantly lower in OPCAB and significant at 1, 4, 12, and 24 hours postoperative. Arrhythmias significantly reduced in OPCAB.

BÖBREK FONKSİYONU

Study	Intervention	Main Result
Loef et al,215 2002	12 CABG and 10 OPCAB	Significantly fewer changes in microalbuminuria, FENa, free H_2O clearance, NAG, and free Hb after OPCAB.
Tang et al,216 2002	20 CABG and 20 OPCAB	No mortality or renal complication in either group.
Ascione et al,5 1999	25 OPCAB and 25 CABG	No ARF in either group. CR clearance and urinary MA/CR significantly worse in CABG ($p < 0,0004$ and $p < 0,0083$). RTF also impaired after CABG ($p < 0,0272$).

KAN KAYBI

Study	Design	Number of Patients		Blood Loss (mL)		*p* Value
		CABG	OPCAB	CABG	OPCAB	
Nuttall et al,223 2003	Retrospective	100	100	290	385	0.003
van Dijk et al,140 2001	RCT	139	142	400	500	0.02
Ascione et al,220 2001	RCT	100	100	943	687	< 0.5
Mehrwal et al,65 2001	Retrospective	991	174	582 ± 76	365 ± 61	<0.001
Ascione et al,119 2000	RCT	30	30	1,049 ± 483	619 ± 294	< 0.001
Kshettry et al,222 2000	Retrospective	690	135	894 ± 503	729 ± 325	< 0.001

ATRİAL FİBRİLASYON

Study	Design	Number of Patients		Incidence of AF		*p* Value
		CABG	OPCAB	CABG	OPCAB	
Salamon et al,230 2003	Retrospective	1,470*	252	11.6	8.8%	NS†
				9.4 and 28%		
Munsette et al,156 2003	RCT	88	88	35.2%	26.1%	
Meharwal et al,231 2003	Retrospective	7,133	4,953	45.3%	30.8%	< 0.001
Meharwal et al,62‡ 2002	Retrospective	2,312	1,075	19.7%	14.3%	< 0.001
Al-Ruzzeh et al,264§ 2001	Retrospective	87	56	41%	29%	0.15
van Dijk et al,140 2001	RCT	139	142	21%	20%	0.79
Lund et al,232 2001	Retrospective	368	165	29.6%	22.4%	
Siebert et al,233 2001	Retrospective	650	118	9.8%	10.2%	0.9
Puskas et al,250‖ 2001	Retrospective	1,000	200	15.8%	10.2%	0.28
Calafiore et al,234 2001	Retrospective	924	919	12%	12%	
Arom et al,143 2000	Retrospective	3,171	350	23%	14%	< 0.001
Cartier et al,235 2000	Retrospective	1,870	300	31%	30%	0.8
Ascione et al,238 2000	RCT	100	100	39%	8%	0.001
Saatvedt et al,200 1999	Retrospective	685	19	36%	37%	

SONUÇ

Study	Study Period	Design	Number		Death		CVA		AMI		Reoperation‡		Hospital Stay (days)	
			CABG	OPCAB	CABG	OPCAB	CABG	OPCAB	CABG	OPCAB	CABG	OPCAB	CABG	OPCAB
Khan et al,300† 2004	2000–2002	RCT	50	54	0	0	NA		0	1.8%	4%	0	7	7
					p = NS				p = NS		p = 0.13		p = 0.08	
Boening et al,301 2003	1998–2001	PMCS	97	72	1.4%	2.8%	1%	1.4%	4.1%	4.3%	2.9%	1.4%	12	13
					p = 0.5		p = NS		p = 0.6		p = NS		p = 0.8	
Calafiore et al,302§ 2003	1994–2001	PMCS	961	961	3.2%	1.4%	NA		1.6%	1%	NA		NA	
					p = 0.01				p = NS					
Calafiore et al,303‖ 2003	1997–2000	Retrospective	896	906	4.3%	4.7%	NA		1.3%	1.6%	2.3%	2.1%	NA	
					p = 0.5				p = 0.4		p = 0.8			
Nathoe et al,259¶ 2003	1998–2000	RCT	139	142	1.4%	1.4%	1.4%	0.7%	6.5%	7%	NA		NA	
					p = 0.98		p = 0.55		p = 0.58					
van Dijk et al,140 2002	1998–2000	RCT	139	142	0	0	1.4%	0.7%	4.3%	4.9%	0	1.4%	7	6
					p = NS		p = 0.55		p = 0.97		p = 0.33		p < 0.01	
Sabik et al,304 2002	1997–2000	PMCS	406	406	1%	0.5%	1.2%	0.7%	1.2%	0.7%	2.5%	4.7%	6	6
					p = 0.7		p = 0.7		p = 0.7		p = 0.5		p = NS	
Hirose et al,305 2002	1991–2001	Retrospective	1089	310	1.2%	0.6%	2%	2.3%	1.3%	0.6%	0.6%		17.5	14.5
					p = NS		p = NS		p = NS		p = NS		p < 0.0001	
Mack et al,306 2002	1995–2000	RAS	10,625	1,915	3.5%	1.9%	2.2%	1.5%	1.8%	0.78%	3.4%	4.9%	7.3	5.9
					p < 0.001		p = NS		p = NS		p < 0.001		p < 0.001	
Angelini et al,307 2002	1997–1999	RCT#	200	200	4%	1%	2%	2%	4%	1%	8%	2%		
					p = 0.50		p = 0.50		p = 0.14		p = 0.32		p = 0.002**	

Off-pump bypass grafting in patients with significant left main coronary artery stenosis

Heart and Vessels
Publisher: Springer Tokyo
ISSN: 0910-8327 (Paper) 1615-2573 (Online)
DOI: 10.1007/s00380-003-0717-9
Issue: Volume 19, Number 1

Date: January 2004 Pages: 8 - 12

Saba D, Ener S, Bicer M, Kan Aytac II, Senkaya I, Ozkan H.
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In significant left main coronary artery stenosis coronary bypass on the beating heart is a safe and effective alternative to the conventional method with the same or better early results. The long-term results need to be evaluated.

Cardiovascular Surgery
Volume 10, Issue 6 , December 2002, Pages 579-585

Is 100% beating heart coronary by-pass justified?

Saba Davit, Isık Senkaya, Abdül Kadir Ercan, Irem Iris Kan and

Hayati Özkan

Uludag University Medical Faculty, Department of Thoracic and Cardiovascular

Surgery, Gorukle, 16059, Bursa, Turkey.

In conclusion, multivessel off pump coronary by-pass is feasible with the same or better results as it is observed in the conventional technique when postoperative bleeding, neurogenic complications, arrythmias, hospital stay, overall morbidity and mortality are compared.

ULUDAĞ ÜNİVERSİTESİ
TIP FAKÜLTESİ

- OPCAB MORTALİTE % 1.9
- CABG MORTALİTE % 1.1
- CBP KONVERSİYON % 2
- OPCAB %74 (92-54)
- CBP KONV. MORT. % 0
- DİSTAL ANAST. 2.5

  OPCAB 2.31

  CABG 3.05

DİSTAL ANASTOMOZ

U.Ü.TIP FAKÜLTESİ

	OPCAB	CABG
3-4-5 BY PASS	3.26	3.51
2-3-4-5 BY PASS	2.65	3.12
1-2-3-4-5 BY PASS	2.31	3.05

OPCAB
Teknik zorunluluklar

1-2 yıl OPCAB yapılan merkezde çalışılmalıdır

Kalbe pozisyon veren ve stabilizasyon sağlayan araç ve teknikleri kullanılmalıdır

Total revaskülarizasyon yapılmalıdır

Anastomoz kalitesinden ödün verilmemelidir

Anestezistin OPCAB deneyimi olmalıdır

Perfüzyonist ekstrakorporel dolaşımı hızla hazırlıyabilmelidir

OPCAB'in sonuçları kabul edilebilir mi?

Az sayıda prospektif randomize
Çok sayıda retrospektif çalışma vardır.

Yeterli eğitim ve yeterli teknik destek ile
Hastaların büyük bir kısmında
Herhangi bir damar grefti kullanarak
Düşük mortalite ve morbidite ile
Mükemmel erken greft açıklığı sağlayacak şekilde
OPCAB tekniği kullanarak
Total miyokardial revaskülarizasyon yapmak mümkündür

Ancak geç dönem sonuçları için prospektif randomize çalışmalara gereksinim vardır

Interactive Cardiovascular and Thoracic Surgery
Volume 3, Issue 2 , June 2004, Pages 302-308

Results after MIDCAB and OPCAB surgeries: problems and consequences of incomplete angiographic follow-up in the mid-term course

Ernst Weigang , , a, Johannes Royla, Andreas Denckera, Joachim Schoellhorna, Andreas van de Loob and Friedhelm Beyersdorfa

Conclusions

The results concerning survival, freedom from events, and clinical status are encouraging. It was not possible to perform angiographic controls in all patients since some of them and their primary physicians could not be convinced of the necessity of this control in the absence of clinical complaints. This explains the negative bias in our results.

The Annals of Thoracic Surgery

Volume 80, Issue 6 , December 2005, Pages 2141-2147

Incomplete Revascularization During OPCAB Surgery is Associated With Reduced Mid-Term Event-Free Survival

Massimo Caputo MD, Barnaby C. Reeves DPhil, Chanaka Rajkaruna, FRCS, Hazaim Awair, FRCS and Gianni D. Angelini , , FRCS

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Compared with off-pump coronary artery bypass surgery patients with complete revascularizations, those with IRs have reduced survival, but only in the first 4 to 6 months after surgery. Patients' preoperative condition, rather than IR itself, may explain these findings because IRs should have mid-term as well as early effects

The Annals of Thoracic Surgery
Volume 80, Issue 6 , December 2005, Pages 2121-2125

Meta-Analysis of Randomized Trials Comparing Off-Pump With On-Pump Coronary Artery Bypass Graft Patency

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bBiostatistics Unit, Centro Cardiologico Monzino IRCCS, University of Milan, Milan, Italy

Conclusions

Cumulative analysis of the few prospective randomized studies currently available in the literature documents a reduction in postoperative patency of coronary artery bypass grafts performed during OPCAB procedures. The risk of reduced graft patency needs to be considered when choosing OPCAB as tailored strategy for selected patients

The Annals of Thoracic Surgery
Volume 80, Issue 6 , December 2005, Pages 2132-2140

Perioperative Patency of Coronary Artery Bypass Grafting is Not Influenced by Off-Pump Technique

Francesco Onorati MD , , Silvio Olivito MD, Pasquale Mastroroberto MD, Antonio di Virgilio MD, Antonio Esposito MD, Andrea Perrotti MD and Attilio Renzulli MD, PhD

Cardiac Surgery Unit, Magna Graecia University of Catanzaro, Catanzaro, Italy

Conclusions

Off-pump coronary artery bypass grafting and cardiopulmonary bypass coronary artery bypass grafting demonstrated similar clinical, biochemical, and transit-time flowmetric results, as well as comparable graft flow reserve. These data exclude a lower anastomotic quality in off-pump coronary artery bypass grafting.

The Annals of Thoracic Surgery
Volume 77, Issue 2 , February 2004, Pages 745-753

Off-pump myocardial revascularization is associated with less incidence of stroke in elderly patients

Thanos Athanasiou MD, PhD, , a, Sharif Al-Ruzzeh FRCSa, Pankaj Kumar FRCSa, Mary-Clare Crossman MRCSa, Mohamed Amrani FRCSa, John R. Pepper FRCSa, Rex Del Stanbridge FRCSa, Roberto Casula FECTSa and Brian Glenville FRCSa
a Department of Cardiothoracic Surgery, The National Heart and Lung Institute, Imperial College of Science, Technology and Medicine, St. Mary's Hospital, London, United Kingdom

We believe that this study suggests that the **OPCAB** technique might be associated with reduced incidence of stroke in the elderly patients undergoing coronary artery bypass grafting.

European Journal of Cardio-Thoracic Surgery
Volume 29, Issue 1 , January 2006, Pages 74-81

Short-term and long-term cognitive function and cerebral perfusion in off-pump and on-pump coronary artery bypass patients

Vladimir I. Chernova, , , Nataliya Yu. Efimovab, Irina Yu. Efimovaa, Shamil D. Akhmedovc and Yuri B. Lishmanova
aDepartment of Nuclear Medicine, Institute of Cardiology, Kievskaya street, 111A, 634012 Tomsk, Russia

Conclusion: The coronary revascularization on beating heart helps significantly to diminish the risk of cerebrovascular complication.

The Annals of Thoracic Surgery

Volume 81, Issue 2 , February 2006, Pages 562-567

Isoprostanes and Oxidative Stress in Off-Pump and On-Pump Coronary Bypass Surgery

Viviana Cavalca Biol Sci[a, b], Erminio Sisillo MD[a], Fabrizio Veglia PhD[a], Elena Tremoli PhD[a, c], Giuliana Cighetti PhD[d], Luca Salvi MD[a], Alessandra Sola PhD[d], Luciana Mussoni PhD[c], Paolo Biglioli MD[a], Giancarlo Folco PhD[c, e], Angelo Sala PhD[c, e] and Alessandro Parolari MD, PhD[a,],
centro Cardiologico Monzino IRCCS, University of Milan, Milan, I

Conclusions

In this randomized study in low-risk coronary patients, **OPCAB** revealed less perioperative oxidative stress, as reflected by lack of excretion of $iPF_{2\alpha}$-III in urine, by lack of increase of plasma free malondialdehyde, and by lower decreases in plasma total antioxidant status

The Annals of Thoracic Surgery
Volume 77, Issue 5 , May 2004, Pages 1567-1574

Do off-pump techniques reduce the incidence of postoperative atrial fibrillation in elderly patients undergoing coronary artery bypass grafting?

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Conclusions

Our study demonstrates a reduced incidence of postoperative atrial fibrillation in an elderly population with off-pump as compared with cardiopulmonary bypass techniques.

The Annals of Thoracic Surgery

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Off-Pump Versus On-Pump Coronary Artery Bypass Grafting in Consecutive Patients: Decision-Making Algorithm and Outcomes

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The **OPCAB** group had higher predicted 30-day mortality compared with the on-pump CABG group, consistent with the protocol's intent. However, morbidity and mortality were similar between on-pump CABG and **OPCAB. The OPCAB** patients received the same number of internal mammary artery grafts but fewer distal grafts. Mortality and observed to expected ratios were favorable for both groups and below those The Society of Thoracic Surgeons' predicted for **OPCAB**

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OPCAB versus early mortality and morbidity: an issue between clinical relevance and statistical significance

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Conclusions: The observed 20% reduction of mortality, 60% reduction of stroke and 20% reduction of dialysis were partly neutralized by the adjusting methods and demand, at least, larger datasets to obtain statistical significance

Journal of the American College of Surgeons

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Off-pump versus on-pump coronary artery bypass surgery: does the pump influence outcome?

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Conclusions

Patients undergoing **OPCAB** had a considerably shorter length of hospitalization, had fewer pulmonary and intraoperative complications, and received a lower volume of blood products.

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Rationale for off-pump coronary revascularization to small branches angiographic study of 1,283 anastomoses in 408 patients

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- **Conclusions**
- **OPCAB** to small coronary artery branches with arterial grafts provided satisfactory graft patency and stenosis free rates.

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- Competitive flow in arterial composite grafts and effect of graft arrangement in Off-Pump coronary revascularization

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Conclusions

Coronary artery revascularization using composite arterial grafts provided satisfactory early patency rates with an acceptable incidence of competitive flow

The Journal of Thoracic and Cardiovascular Surgery

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Activation of the coagulation system during coronary artery bypass grafting: Comparison between on-pump and off-pump techniques

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Conclusion

Although the extrinsic coagulation pathway is similarly activated, thrombin formation is more pronounced in patients having on-pump bypass grafting. Patients subjected to off-pump bypass grafting have normally functioning platelets and a weak activation of the fibrinolytic system. At discharge, both groups have preserved platelet function and increased thrombin formation. Further studies with angiographic evaluation are needed to establish a correlation between coagulation parameters, platelet function, and graft patency.

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Off-Pump coronary artery bypass operation does not increase procoagulant and fibrinolytic activity: preliminary results

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Conclusions

Despite lower systemic anticoagulation activation of coagulation and fibrinolysis is reduced in **OPCAB** compared with on-pump CABG. Reduced thrombin generation and reduced fibrinolytic activity in **OPCAB** indicates better preservation of hemostasis. We suggest the term "preserved hemostasis" instead of "hypercoagulant activity" with respect to **OPCAB.**

European Journal of Cardio-Thoracic Surgery

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Meta-analysis on the effect of off-pump coronary bypass surgery

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Based on our results **OPCAB** appears to be equivalent to CABG.

European Journal of Cardio-Thoracic Surgery

Article in Press

Morbidity and mortality following acute conversion from off-pump to on-pump coronary surgery

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Conclusions: Experienced OPCAB surgeons have a low risk of acute conversion. Acutely converted patients have a moderately increased risk of death and serious complications in hospital. These risks are difficult to quantify precisely because conversion is rare.

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Resource utilization in on- and off-pump coronary artery surgery: Factors influencing postoperative length of stay—an experience of 1,746 consecutive patients undergoing fast-track cardiac anesthesia

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Conclusion: The authors found that patients undergoing on-pump CABG have significantly longer time to tracheal extubation, increased blood use, longer ICULOS, PLOS, and total LOS and higher in-hospital mortality, which would translate into significant differences in the expenses associated with these 2 surgical approaches to coronary surgery.

European Journal of Cardio-Thoracic Surgery

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- On-pump beating heart versus off-pump coronary artery bypass surgery—evidence of pump-induced myocardial injury

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Conclusions: In this randomized study on routine coronary patients with normal ventricular function, **OPCAB** revealed less myocardial injury than OnP-BH. These findings implicate that CPB slightly affects the myocardium