

CHIRURGIA CORONARICA MINIINVASIVA: Quale ruolo dopo 50 anni di rivascularizzazione miocardica

Luigi Martinelli
Direttore Dipartimento Chirurgico

ICLAS – Istituto Clinico Ligure di Alta Specialità

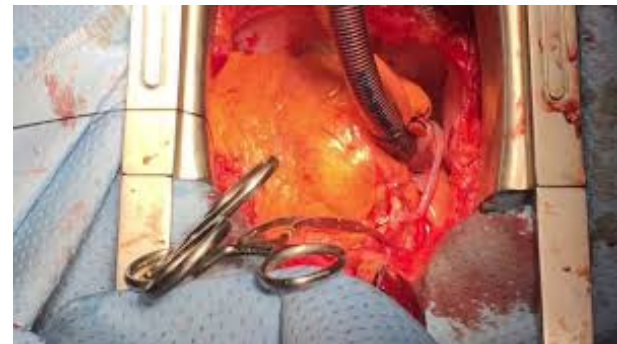
CHIRURGIA CORONARICA 2.0

REQUISITI DI PERFORMANCE

- Rivascolarizzazione «completa»
- Utilizzo di 2 mammarie
- Incidenza di stroke < 1%
- Mortalità a 30 gg < 1%
- Pervietà condotti arteriosi > 95% a 1 anno
- Assenza di recidive a 5 anni

CHIRURGIA CORONARICA CONVENZIONALE

- Sternotomia mediana
- Prelievo «open» dei condotti
- Utilizzo CEC
- Clampaggio aortico / cardioplegia
- Clampaggio aortico tangenziale per anastomosi prossimali

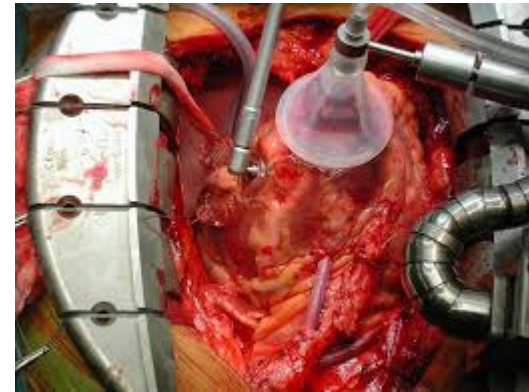


CHIRURGIA CORONARICA MINIINVASIVA: la gamma delle opzioni

- Sternotomia /no CEC (OPCAB)
- Mini-toracotomia sinistra /no CEC (MIDCAB)
- Mini-toracotomia sinistra / CEC (Heartport)
- Minitoracotomia bilaterale / no CEC
- Bypass endoscopico (TECAB)
- Bypass endoscopico con robot (RA-TECAB)

Rivascolarizzazione

- LIMA > IVA, multivasale arteriosa



CHIRURGIA CORONARICA MINIINVASIVA

Obiettivi

- Riduzione trauma da accesso
- Eliminazione danni CEC e clampaggio

Presupposti

- Mantenere qualità delle anastomosi
- Garantire rivascolarizzazione adeguata
- Utilizzare condotti arteriosi

Condizioni permittenti

- Adeguato training e competenza del chirurgo e del team

CHIRURGIA CORONARICA OFF-PUMP: SVILUPPO E DIFFUSIONE

- **Fase iniziale: (1990-2000)**
 - Sud America, Bristol (Bonatti, Angelini, Ascione)
 - Sviluppo della tecnica, sviluppo dei materiali
 - Applicazione di accessi non sternotomici (MIDCAB)
 - Dati consistenti , tecnica riproducibile, RCT positivi da Bristol
- **Fase intermedia: (2000 – 2010)**
 - Diffusione della tecnica (da 20% a 90% dei CABG in molti Centri)
 - Perplessità sui risultati (ROOBY trial 2009)
 - MIDCAB rimane intervento di nicchia
- **Fase attuale: (2010- 2016)**
 - Stabilizzazione dell'utilizzo (10% EU-USA, 60% GIAPPONE)
 - Utilizzo in Centri dedicati (>80% dei CABG)
 - Sviluppo della tecnica «IBRIDA» (LG ESC-EACTS 2014)
 - RCT inconcludenti (Coronary) – Studi osservazionali «entusiasti» (Mack, Cleveland)

ON-PUMP VS OFF-PUMP

The NEW ENGLAND JOURNAL *of* MEDICINE

ESTABLISHED IN 1812

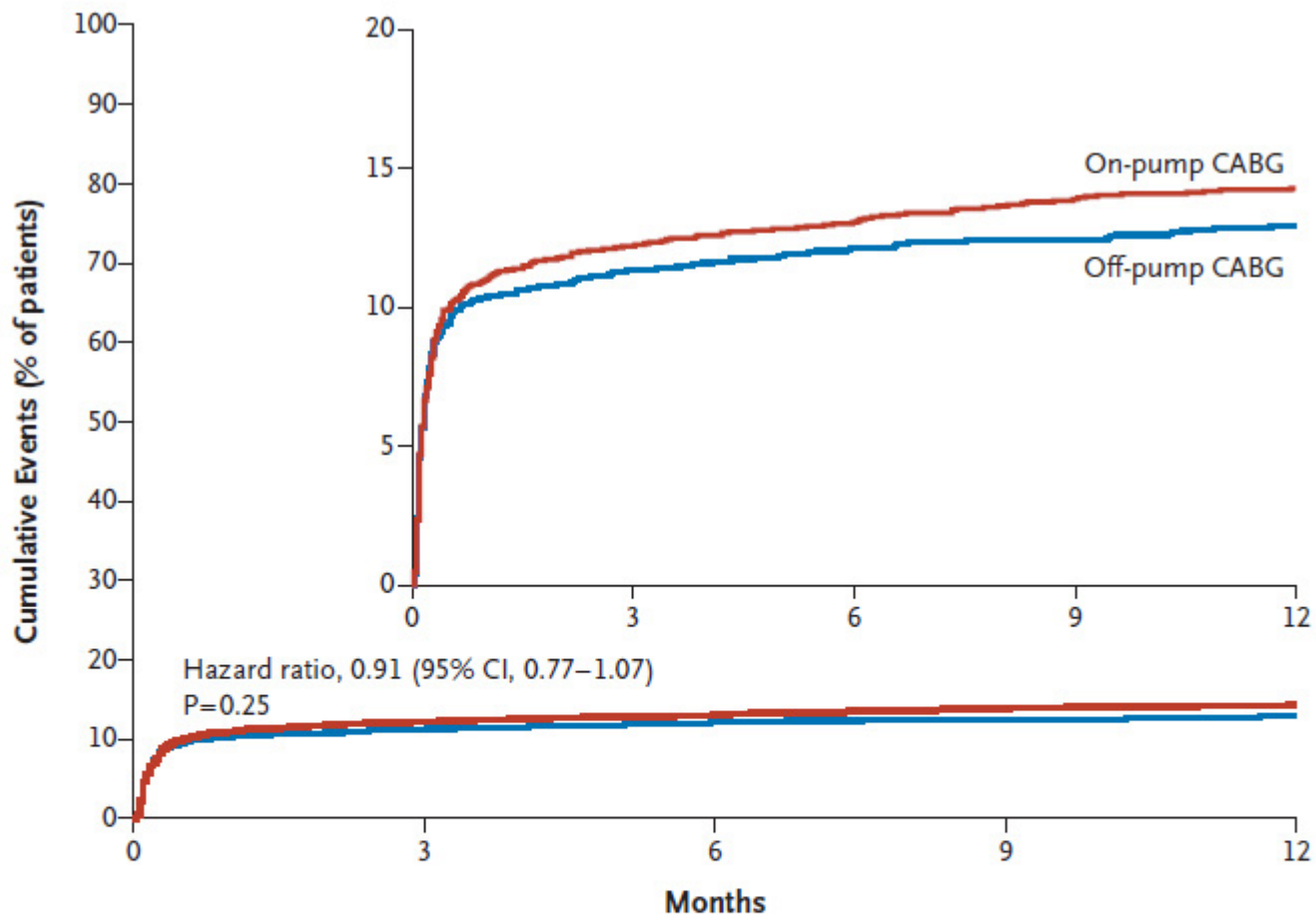
MARCH 28, 2013

VOL. 368 NO. 13

Effects of Off-Pump and On-Pump Coronary-Artery Bypass Grafting at 1 Year

- 4752 patients at 79 centers in 19 countries [scheduled to undergo CABG](#) and randomly assigned to off-pump or on-pump
- PRIMARY END POINTS:
 - composite rate of death, nonfatal stroke, nonfatal myocardial infarction, or new dialysis at 30 days and at 1 year
 - Quality of life and cognitive function
- SECONDARY END POINT:
 - Primary e.p. plus rate of repeat revascularization

N ENGL J MED 368;13 NEJM.ORG MARCH 28, 2013



No. at Risk

Off-pump CABG	2375	2115	2097	2069	2054
On-pump CABG	2377	2098	2080	2044	2032

Figure 1. Kaplan–Meier Curves for the Primary Composite Outcome at 1 Year.

The primary outcome was the composite of death, nonfatal myocardial infarction, nonfatal stroke, or nonfatal new renal failure requiring dialysis. The inset shows the same data on an enlarged y axis.

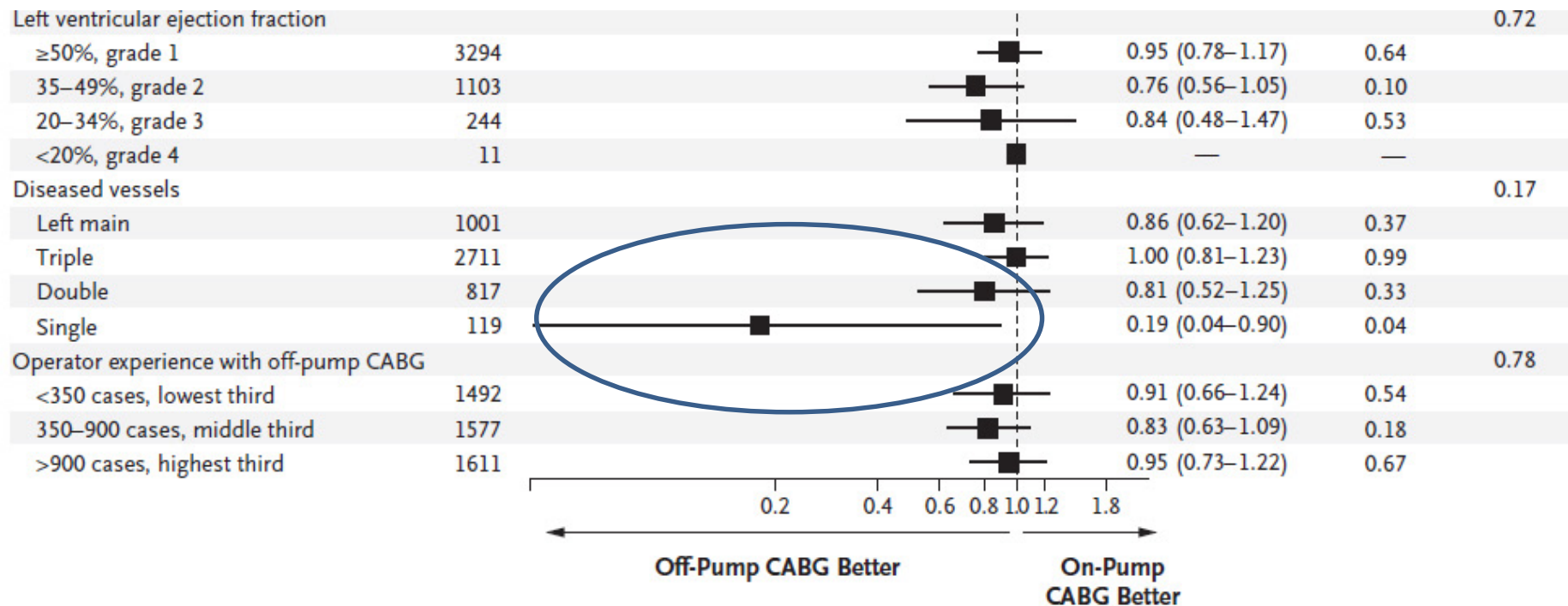


Figure 2. Hazard Ratios for the Primary Outcome in Prespecified Subgroups.

Grades of 0 to 2 on the European System for Cardiac Operative Risk Evaluation (EuroSCORE) for CABG indicate low risk; 3 to 5, moderate risk; and more than 5, high risk. The body-mass index is the weight in kilograms divided by the square of the height in meters.

.

In conclusion, we conducted a large, randomized trial to compare the outcomes of on-pump CABG with off-pump CABG. At 1 year, we found **no significant differences between the two groups in the rate of death, nonfatal stroke, nonfatal myocardial infarction, or nonfatal new renal failure requiring dialysis or in the rate of subsequent revascularization procedures.** We also found no significant differences in quality of life or in neurocognitive function.

Off-pump versus on-pump coronary artery bypass grafting surgery in high-risk patients: PRAGUE-6 trial at 30 days and 1 year

Jan Hlavicka^a, Zbynek Straka^a, Stepan Jelinek^a, Petr Budera^a, Tomas Vanek^a, Marek Maly^b, Petr Widimsky^a

Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 2016 Jun; 160(2):263-270.

PRAGUE-6 is a prospective randomized single-center study of 206 patients, **with an additive EuroSCORE ≥ 6** , scheduled for isolated coronary surgery: Group A - on-pump (n = 108) versus Group B - off-pump (n = 98).

Table 4. Results after 30 days and after 1 year (intention-to-treat)[#].

Results after 30 days	Group A	Group B	<i>P</i>	HR (95% CI)
	On-Pump (107)	Off-Pump (98)		
Combined prim. endpoint - no. (%)	22 (20.6)	9 (9.2)	0.028	0.41 (0.19-0.91)
Death	6 (5.6)	4 (4.1)	0.623	0.73 (0.21-2.58)
AMI	13 (12.1)	4 (4.1)	0.048	0.32 (0.11-0.99)
Stroke	3 (2.8)	2 (2.0)	0.726	0.73 (0.12-4.35)
Hemodialysis required	5 (4.7)	1 (1.0)	0.163	0.22 (0.03-1.85)
Coronary re-intervention	1 (0.9)	1 (1.0)	0.953	1.09 (0.07-17.37)

Results after 1 year	Group A	Group B	<i>P</i>	HR (95% CI)
	On-Pump (107)	Off-Pump (98)		
Combined prim. endpoint - no. (%)	33 (30.8)	21 (21.4)	0.117	0.65 (0.37-1.12)
Death	11 (10.3)	16 (16.3)	0.210	1.63 (0.76-3.52)
AMI	16 (15.0)	8 (8.2)	0.148	0.53 (0.23-1.25)
Stroke	5 (4.7)	2 (2.0)	0.323	0.44 (0.08-2.26)
Hemodialysis required	6 (5.6)	1 (1.0)	0.113	0.18 (0.02-1.50)
Coronary re-intervention	3 (2.8)	5 (5.1)	0.373	1.92 (0.46-8.02)

[#] without one patient lost to 30days and 1 year follow-up, AMI - acute myocardial infarction, HR - hazard ratio

CONCLUSIONS

Our hypothesis that high-risk patients would benefit from avoiding ECC, **was not supported** by the PRAGUE-6 study. However, it did show that off-pump surgery is associated **with a lower incidence of serious complications**, especially MI and global ischemia, during the first 30 post-operative days. It appears to be safer and should become the preferred technique for direct revascularization in extremely ill patients. In addition, from the point of view of the surgeon, the observed $\approx 10\%$ lower incidence of major post-operative complications at 1 year could also impact the decision regarding which technique to use.

A meta-analysis of large randomized trials for mid-term major cardio- and cerebrovascular events following off-pump versus on-pump coronary artery bypass grafting

Hisato Takagi*, Taku Watanabe, Yusuke Mizuno, Norikazu Kawai and Takuya Umemoto, for the ALICE (All-Literature Investigation of Cardiovascular Evidence) Group

Background:

Lo studio ROOBY e una loro precedente metanalisi (ALICE) mostrano un aumento di mortalità e MACCE nei pazienti off-pump a 1 anno. Allo scopo di verificare questi dati viene ripetuta una metanalisi basata su studi ampi e recenti

Metodo: analisi di 8 RCT includenti >100 paz. per un totale di 10954 paz

H. Takagi et al. / Interactive CardioVascular and Thoracic Surgery

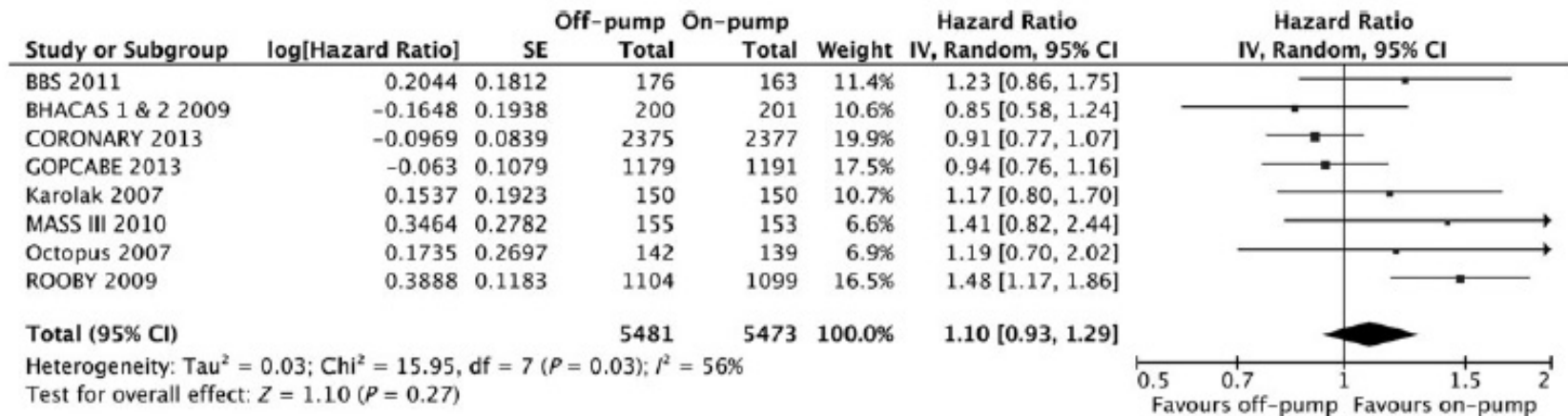


Figure 1: Forest plot of HRs for major adverse cardiovascular (and cerebrovascular) events among patients randomized to off-pump vs on-pump CABG : **no statistically significant difference in off-pump and on-pump CABG**

The results of our analysis suggest that **off-pump CABG may not increase MACE** over on-pump CABG. This result was robust in sensitivity analyses, even eliminating the CORONARY and the trial by Karolak et al. , in which repeat revascularization was not included in MACE

On- vs. off-pump coronary artery bypass grafting: A systematic review and meta-analysis

Gudrun Dieberg^{a,1}, Neil A. Smart^{a,1}, Nicola King^{b,*,2}

Background:

To reduce complications during coronary artery bypass grafting (CABG) off-pump CABG was introduced; however, results have been mixed.

Aim of the study:

To conduct a systematic review and metaanalysis of off-pump vs. on-pump CABG. Fifty four studies (59 intervention groups), totalling 16,261 participants were analysed.

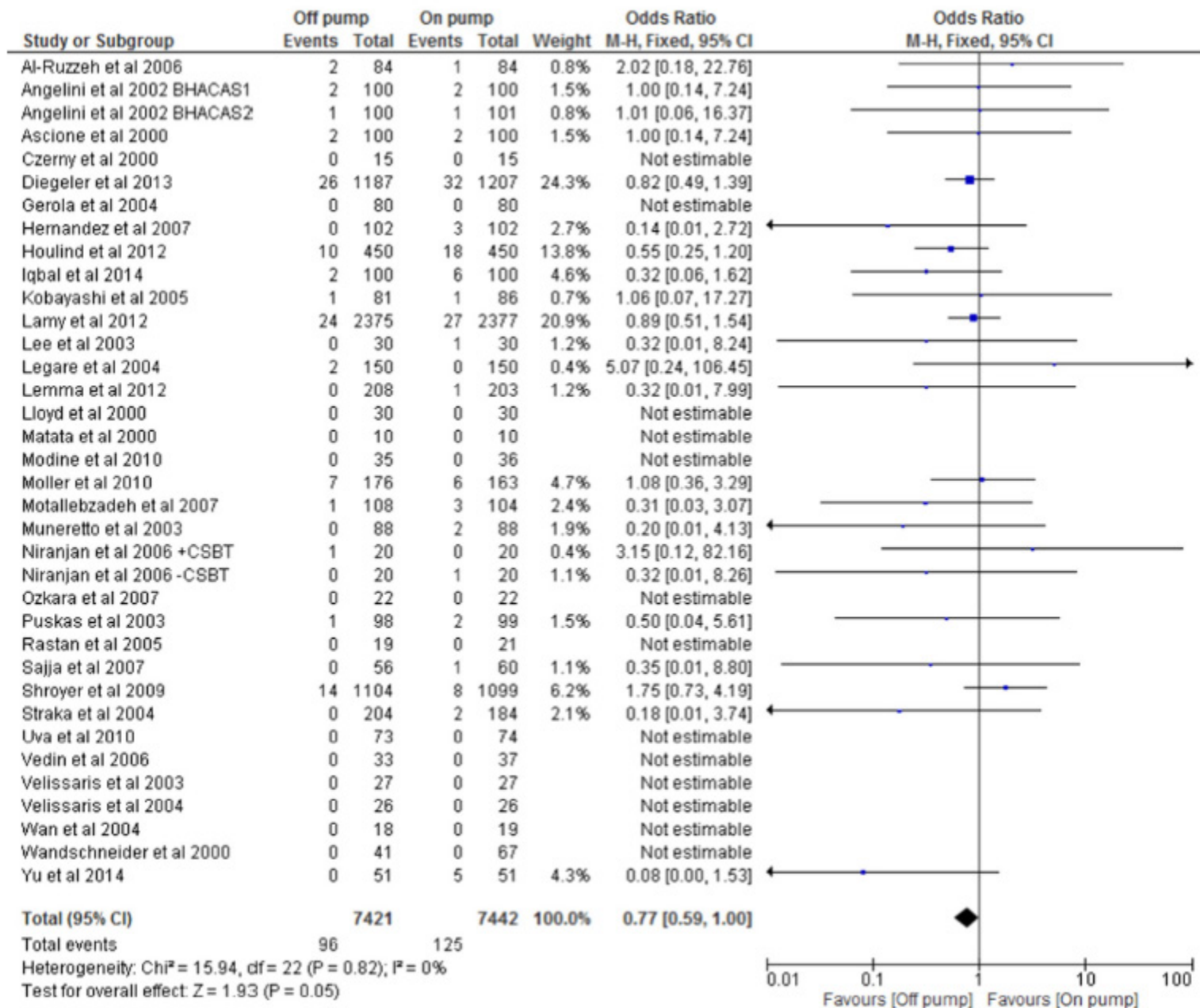


Fig. 4. Incidence of stroke.

In our meta-analysis, on-pump CABG was associated with a higher incidence of post-operative atrial fibrillation, no difference in either myocardial infarction or mortality, a strong trend towards a reduced incidence of stroke in the off-pump group, and significantly shorter duration of ventilation, ICU stay and hospital stay in the off-pump group.

APPROCCI NON STERNOTOMICI

Outcomes after different non-sternotomy approaches to left single-vessel revascularization: a comparative study with up to 10-year follow-up

Anton Sabashnikov^{a,b,*}, Nikhil P. Patil^a, Alexander Weymann^a, Prashant N. Mohite^a, Bartłomiej Zych^a, Diana García Sáez^a, Aron-Frederik Popov^a, Thorsten Wahlers^b, Thorsten Wittwer^b, Jens Wippermann^b, Mohamed Amrani^a, Richard Trimlett^a, André R. Simon^a, John Pepper^a and Toufan Bahrami^a

European Journal of Cardio-Thoracic Surgery 46 (2014) e48–e55
doi:10.1093/ejcts/ezu287 Advance Access publication 26 July 2014

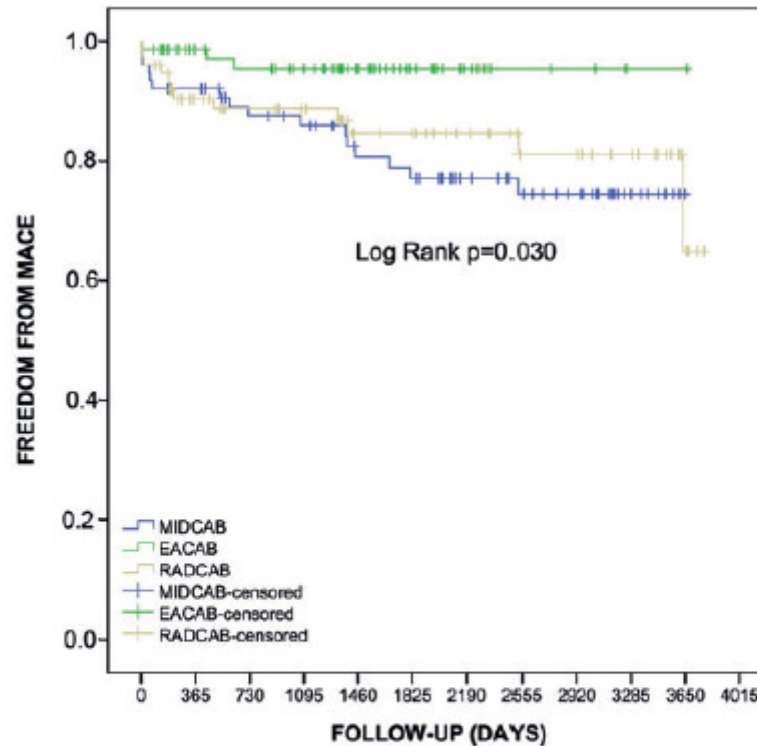
A total of 502 patients having **single-vessel LAD** disease treated from April 2003 to May 2013 by **minimally invasive direct coronary artery bypass grafting (MIDCAB)**, **endoscopically assisted coronary artery bypass grafting (EACAB)** or **robotically assisted direct coronary artery bypass grafting (RADCAB)** were reviewed. In all cases, distal anastomoses were performed through anterolateral **minithoracotomy incisions**.

Table 3: Intraoperative data and postoperative outcome

	MIDCAB (n = 189)	EACAB (n = 76)	RADCAB (n = 236)	P-value
Operation duration	100 (80;130)	120 (92;149)	230 (205;260)	<0.001
Conversion to CPB	2 (1.1%)	1 (1.3%)	6 (2.5%)	0.494
Intraoperative IABP	1 (0.5%)	1 (1.3%)	0	0.267
ICU stay (days)	1.15 ± 0.13	1.25 ± 0.63	0.98 ± 0.63	0.956
Postoperative stay (days)	6.99 ± 0.38	7.00 ± 0.39	7.35 ± 0.71	0.892
ICU readmission	3 (3%)	0	0	0.239
Need for transfusions	15 (13.9%)	0	4 (3.7%)	0.009
Reopening for bleeding	3 (1.6%)	1 (1.3%)	4 (1.7%)	0.975
IABP postoperatively	1 (0.5%)	0	1 (0.4%)	0.823
Arrhythmia requiring intervention				
Atrial fibrillation/flutter	33 (17.5%)	13 (17.1%)	33 (13.9%)	0.299
Permanent pacemaker	0	1 (1.3%)	0	
SVT	0	0	1 (0.4%)	
VF/VT	1 (0.5%)	0	0	
Neurological complications	2 (1.1%)	0	0	0.190
Wound infections				
Superficial	14 (7.4%)	2 (2.6%)	4 (1.7%)	0.012
Deep	2 (1.1%)	0	0	
Renal failure				
Compensated ^a	6 (3.2%)	4 (5.3%)	7 (3.0%)	0.605
Haemofiltration	4 (2.1%)	2 (2.6%)	2 (0.8%)	
No renal failure	179 (94.7%)	70 (92.1%)	228 (96.2%)	
Gastrointestinal complications	6 (3.2%)	1 (1.3%)	5 (2.1%)	0.621
Multiorgan failure	2 (1.1%)	0	1 (0.4%)	0.534
In-hospital mortality	2 (1.1%)	0	1 (0.4%)	0.534
In-hospital coronary reintervention	1 (0.5%)	0	0	0.436

European Journal of Cardio-Thoracic Surgery 46 (2014) e48–e55
doi:10.1093/ejcts/ezu287 Advance Access publication 26 July 2014

Outcomes after different non-sternotomy approaches to left single-vessel revascularization: a comparative study with up to 10-year follow-up



	1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years	9 years	10 years
MIDCAB										
Survival	92.1%	87.6%	86.0%	80.7%	77.1%	77.1%	74.5%	74.5%	74.5%	74.5%
No at risk	67	57	54	45	43	34	29	24	11	1
EACAB										
Survival	98.7%	95.4%	95.4%	95.4%	95.4%	95.4%	95.4%	95.4%	95.4%	95.4%
No at risk	62	59	53	36	23	11	5	4	1	1
RADCAB										
Survival	90.4%	88.8%	88.8%	84.6%	84.6%	84.6%	81.1%	81.1%	81.1%	64.9
No at risk	57	51	47	37	35	30	21	21	15	4

European Journal of Cardio-Thoracic Surgery 46 (2014) e48–e55
 doi:10.1093/ejcts/ezu287 Advance Access publication 26 July 2014

Outcomes after different non-sternotomy approaches to left single-vessel revascularization: a comparative study with up to 10-year follow-up

CONCLUSION

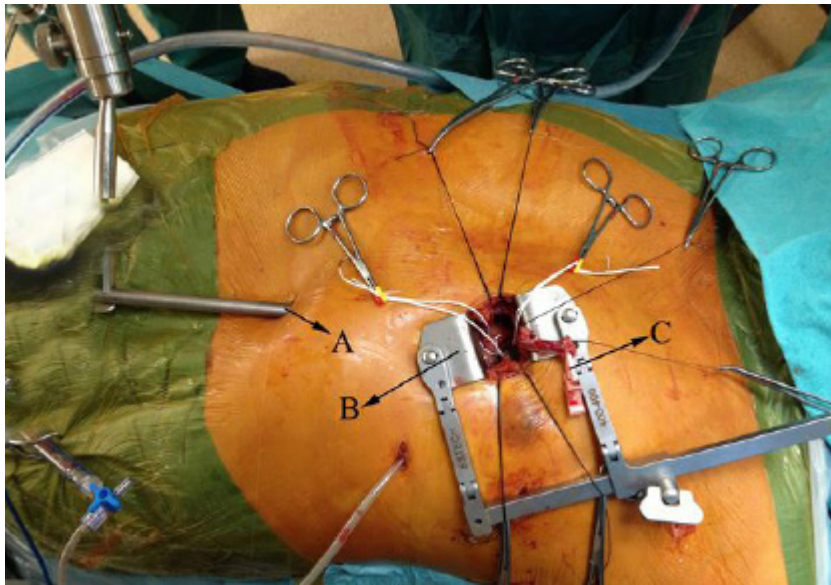
MIDCAB, EACAB and RADCAB approaches in single-vessel coronary revascularization are clinically safe and effective, with comparable in-hospital mortality and long-term survival. However, the **endoscopic approach** was found to be free from the disadvantages of longer operating duration observed in the RADCAB or higher incidence of angina and shorter freedom from MACEs in both the MIDCAB and RADCAB groups.

European Journal of Cardio-Thoracic Surgery 46 (2014) e48–e55
doi:10.1093/ejcts/ezu287 Advance Access publication 26 July 2014

The Comparison between Minimally Invasive Coronary Bypass Grafting Surgery and Conventional Bypass Grafting Surgery in Proximal LAD Lesion

Mehmet Ezelsoy, MD,¹ Baris Caynak, MD,² Muhammed Bayram, MD,¹ Kerem Oral, MD,¹
Zehra Bayramoglu, MD,¹ Ertan Sagbas, MD,² Vedat Aytekin, MD,³ Belhan Akpınar, MD¹

¹Cardiovascular Surgery Department and ³Cardiology Department, Istanbul Florence Nightingale Hospital; and ²Cardiovascular Surgery Department, Istanbul Bilim University, Istanbul, Turkey



The Heart Surgery Forum #2015-471

Table 2. Intraoperative Results*

	Conventional Bypass	Robotic Bypass	P
LAD stenosis, %	86.00 ± 12.24	90.57 ± 10.49	.098
Operation time, min	–	186.93	–
LIMA take down, min	–	48.17	–
CPB, min	31.49 ± 6.32	–	–
Cross Clamp, min	15.74 ± 4.83	–	–

*Data are presented as the mean ± SD where indicated. LAD indicates left anterior descending artery; LIMA, left internal mammary artery; CPB, cardiopulmonary bypass.

Table 3. Postoperative Results*

	Conventional Bypass	Robotic Bypass	P
Transfusion	0.60 ± 0.91	0.23 ± 0.55	.044**
Ventilation, h	5.23 ± 0.97	4.69 ± 1.2	.042**
ICU stay, d	1.66 ± 0.97	1.09 ± 0.28	.002***
Hospital stay, d	7.80 ± 2.29	6.63 ± 1.03	.008***
Postoperative pneumonia, n (%)	7 (20)	0 (0)	.005***
Postoperative ARF, n (%)	2 (6)	0 (0)	.151
Postoperative arrhythmia, n (%)	6 (17)	5 (14)	.743

Our results are consistent with the literature and lead us to **assume the future importance and prevalence of minimally invasive interventions**. The results regarding the early period of robotic surgery are promising. We think that robotic surgery will take its place as routine as a result of technical advances in the anastomosis instruments and endoscopic stabilizers.

The Heart Surgery Forum #2015-471

MINIMALLY INVASIVE MULTIVESSEL CORONARY SURGERY AND HYBRID CORONARY REVASCULARIZATION: CAN WE ROUTINELY ACHIEVE LESS INVASIVE CORONARY SURGERY?

Maria Rodriguez, M.D.; Marc Ruel, M.D., M.P.H.

University of Ottawa Heart Institute, Ontario, Canada

Minimally Invasive Multivessel Coronary Surgery

- MICS-CABG through a small thoracotomy allows multiple anastomosis
- The surgical exposure, more lateral, reduces rib injury.
- MICS-CABG enables direct-vision LIMA harvesting and hand-sewn proximal and distal anastomoses
- MICS may be performed with or without CPB assistance
- **With MICS-CABG, complete myocardial revascularization is achievable in more than 95% of cases since the technique allows access to the anterior, lateral, and inferior walls of the heart**

PROCEDURE IBRIDE



2014 ESC/EACTS Guidelines on myocardial revascularization

The Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

Developed with the special contribution of the European Association of Percutaneous Cardiovascular Interventions (EAPCI)

Hybrid procedures

Hybrid procedure, defined as consecutive or combined surgical and percutaneous revascularization may be considered in specific patient subsets at experienced centres.

IIb

C

Comparison of Hybrid Coronary Revascularization Versus Coronary Artery Bypass Grafting in Patients ≥ 65 Years With Multivessel Coronary Artery Disease



Ralf E. Harskamp, MD^{a,b,*}, John D. Puskas, MD, MS^c, Jan G. Tijssen, PhD^b, Patrick F. Walker, BS^c, Henry A. Liberman, MD^c, Renato D. Lopes, MD, PhD^a, Thomas A. Vassiliades, MD, MBA^c, Eric D. Peterson, MD, MPH^a, and Michael E. Halkos, MD, MS^c

Hybrid coronary revascularization (HCR) combines minimally invasive left internal mammary artery to left anterior descending coronary artery grafting with percutaneous coronary intervention of non left anterior descending coronary arteries. The safety and efficacy of HCR in patients ≥ 65 years of age is unknown.

Am J Cardiol 2014;114:224e229

Table 2
Short-term outcomes and recovery parameters

	HCR (n = 143)	CABG (n = 572)	OR (95% CI)	p-Value
Major cerebrovascular and cardiac events at 30 days	8 (5.6%)	22 (3.8%)	1.46 (0.65–3.27)	0.36
All-cause mortality	4 (2.8%)	15 (2.6%)	1.07 (0.35–3.21)	0.91
Myocardial infarction	2 (1.4%)	0 (0.0%)	—	—
Permanent stroke	2 (1.4%)	8 (1.4%)	1.00 (0.21–4.71)	1.00
Procedural complications	13 (9.1%)	104 (18.2%)	0.50 (0.28–0.89)	0.018
Renal failure	3 (2.1%)	18 (3.1%)	0.67 (0.20–2.26)	0.52
Prolonged ventilation (>24 h)	8 (5.6%)	83 (14.5%)	0.39 (0.19–0.80)	0.010
Access site infection	0 (0.0%)	8 (1.4%)	—	—
Reoperation	6 (4.2%)	33 (5.8%)	0.47 (0.31–1.74)	0.47
Bleeding events				
Coronary Artery Bypass Graft–related bleeding	10 (7.0%)	64 (11.2%)	0.63 (0.32–1.22)	0.17
Chest tube drainage (mL/24 h)	838 ± 484	1100 ± 579	$\beta = -0.18$ (t = -4.94)	<0.001
Need for blood transfusion	40 (28.0%)	305 (53.3%)	0.53 (0.38–0.73)	<0.001
Recovery parameters				
Post-operative length of stay <5 days	65 (45.5%)	157 (27.4%)	1.66 (1.24–2.21)	0.001
Post-operative length of stay >10 days	8 (5.6%)	85 (14.9%)	0.38 (0.18–0.78)	0.008
Discharge home	129 (90.2%)	492 (86.0%)	1.05 (0.86–1.27)	0.63

Data are expressed as mean ± standard deviation for normally distributed data or number (%) for categorical variables.

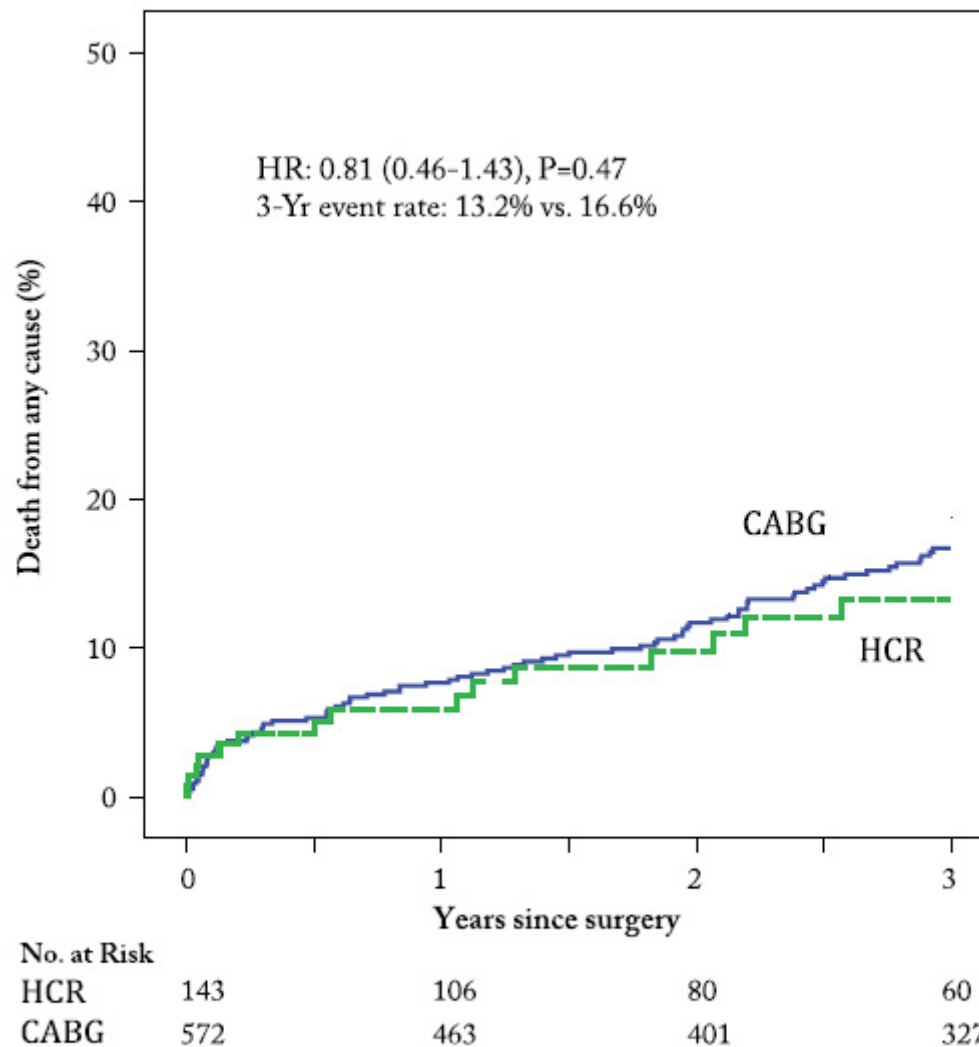


Figure 1. Kaplan-Meier curve for death from any cause up to 3 years after HCR and conventional bypass surgery. Shown are rates of death from any cause truncated at 3 years after surgery. The hazard ratio (HR) was calculated using Cox modeling stratified on matched pairs.

Advanced hybrid closed chest revascularization: an innovative strategy for the treatment of multivessel coronary artery disease[†]

Nikolaos Bonaros^{a,*}, Thomas Schachner^a, Markus Kofler^a, Eric Lehr^b, Jeffrey Lee^c, Mark Vesely^d, David Zimrin^d, Gudrun Feuchtner^e, Guy Friedrich^f and Johannes Bonatti^g

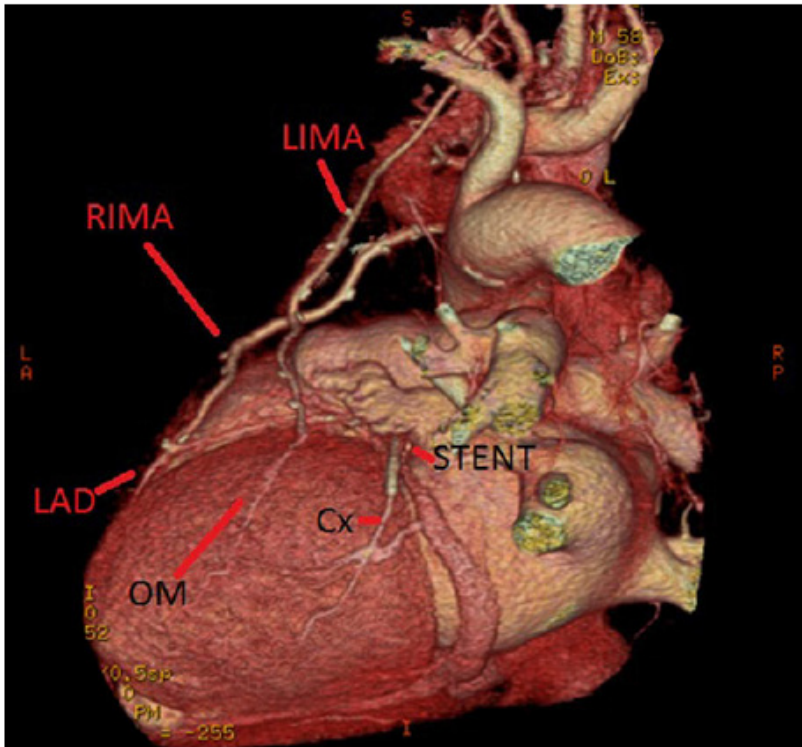
OBJECTIVES:

In this study we assess perioperative and midterm outcomes of advanced hybrid revascularization (AHR) defined as the combination of single or multivessel (MV) totally endoscopic coronary artery bypass grafting (TECAB) with single or multivessel PCI.

METHODS: 90 AHR patients were compared with 90 CHR patients in terms of perioperative and mid-term outcomes. The outcomes of the three different AHR options (MV-TECAB + PCI, MV-PCI + TECAB, MV-TECAB + MV-PCI) as well as the sequence of the interventions were further compared. Risk factors for major adverse cardiac and cerebral events (MACCEs) related to the hybrid revascularization strategy were calculated.

Table 2: Perioperative results

	AHR (n = 90)	CHR (n = 90)	P-value
Total operation time (min)	337 (137-794)	272 (148-550)	0.002
CPB time (min)	117 (44-263)	78 (40-190)	<0.001
Cross-clamp time (min)	91 (35-207)	57 (38-129)	<0.001
Total RBC needed	1 (0-10)	0 (0-4)	0.061
Total FFP needed	0 (0-12)	0 (0-5)	0.072
Total PLT needed	0 (0-3)	0 (0-2)	0.078
Intubation time (h)	10 (0-704)	9 (0-113)	0.693
ICU stay (h)	40 (14-1048)	22 (13-339)	0.162
Length of stay (days)	6 (2-54)	6 (3-31)	0.238
CK max (mg/dl)	447 (75-3087)	759 (71-11 462)	0.008
CK-MB max (mg/dl)	25 (10-49)	22 (8-162)	0.174
Learning curve case	44 (48.9%)	18 (20%)	0.00007
Surgical difficulties	27 (30%)	17 (18.9%)	0.118
IMA injury	6 (6.7%)	2 (2.2%)	0.211
Anastomotic problem	6 (6.7%)	1 (1.1%)	0.118
Cannulation problem	12 (13.3%)	13 (14.4%)	0.219
Conversion	4 (4.4%)	0 (0%)	0.060
Revision for bleeding	2 (2.2%)	5 (5.6%)	0.278
Aortic dissection	1 (1.1%)	0 (0%)	1.000
Myocardial infarction	3 (3.3%)	3 (3.3%)	0.196
Atrial fibrillation	16 (17.8%)	17 (18.8%)	0.916
Stroke	0 (0%)	1 (1.1%)	0.497
Renal failure requiring HF	0 (0%)	0 (0%)	n.a.
Wound complications	1 (1.1%)	0 (0%)	0.364
Death	0 (0%)	0 (0%)	n.a.



European Journal of Cardio-Thoracic Surgery
46 (2014) e94–e102

Table 3: Outcome according to the type of advanced hybrid revascularization

	MV-TECAB (n = 59)	MV-PCI (n = 13)	MV-TECAB + MV-PCI (n = 18)	P-value
Conversion	2 (3.4%)	0 (0%)	2 (11%)	0.267
OR time (min)	353 (158–794)	190 (137–375)	346 (189–625)	0.005
ICU stay (h)	26 (15–240)	99 (17–161)	49 (18–872)	0.138
Length of stay (days)	6 (3–20)	6 (3–11)	6 (4–49)	0.568
Perioperative death	0	0	0	n.a.
Surgical difficulties	18 (30.5%)	1 (7.7%)	8 (44.4%)	0.087
Conversion	2 (3.4%)	0 (0%)	2 (11.1%)	0.267
Rethoracotomy for bleeding	2 (3.4%)	0 (0%)	0 (0%)	0.584
Undesired event	5 (8.5%)	1 (7.7%)	4 (22.2%)	0.436
Vascular complication	0 (0%)	1 (7.7%)	0 (0%)	0.050
Leg ischaemia	0 (0%)	0 (0%)	0 (0%)	n.a.
Myocardial infarction	0 (0%)	0 (0%)	1 (5.6%)	0.028
Atrial fibrillation	11 (18.6%)	2 (15.4%)	3 (16.7%)	0.184
Stroke	0 (0%)	0 (0%)	0 (0%)	n.a.
Renal failure requiring HF	0 (0%)	0 (0%)	0 (0%)	n.a.
Respiratory failure	2 (3.4%)	0 (0%)	1 (5.6%)	0.696
Wound complications	1 (1.7%)	0 (0%)	0 (0%)	0.378
Death	0 (0%)	0 (0%)	0 (0%)	n.a.
Death (follow-up)	0	0	0	n.a.
MACCE (follow-up)	7 (12.1%)	2 (15.4%)	3 (16.7%)	0.862
TECAB-TVRR	2 (3.4%)	1 (7.7%)	0 (0%)	0.750
PCI-TVRR	2 (3.4%)	0 (0%)	2 (11%)	0.532

MV-TECAB: multivessel totally endoscopic coronary bypass grafting; MV-PCI: multivessel percutaneous intervention; MACCE: major adverse cardiac and cerebral events; TECAB-TVRR: revascularization of the TECAB target; PCI-TVRR: revascularization of the PCI target; n.a.: not applicable; HF: hemofiltration; OR: operation room.

CONFRONTI CON PCI

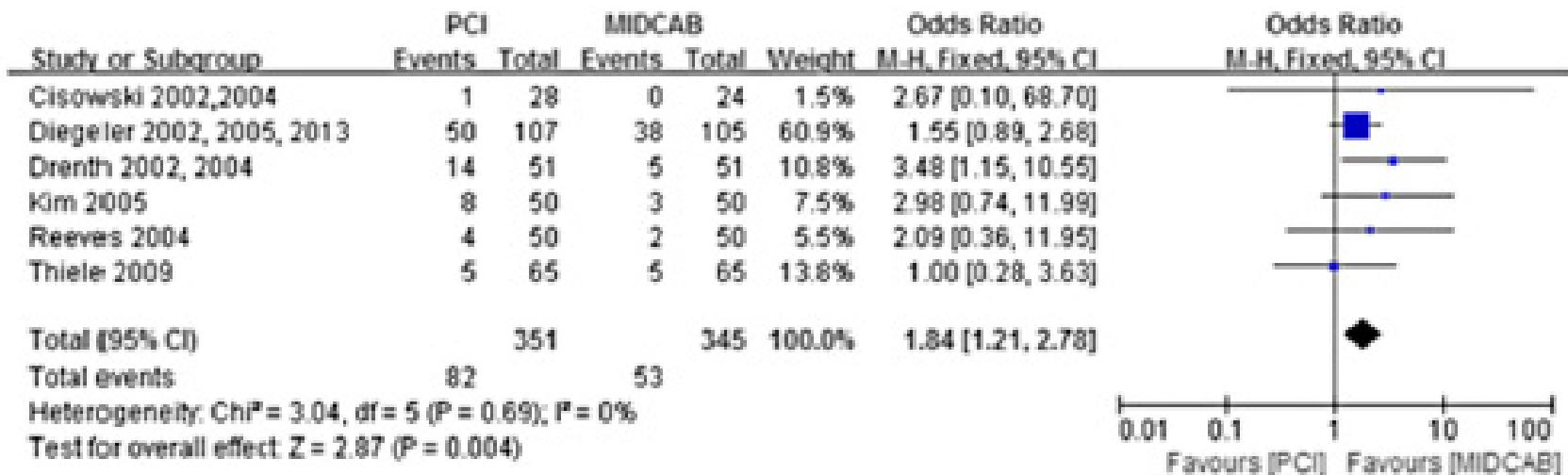
Minimally invasive direct coronary bypass compared with percutaneous coronary intervention for left anterior descending artery disease: a meta-analysis

Xiao-Wen Wang^{1,2†}, Can Qu^{3†}, Chun Huang^{1*}, Xiao-Yong Xiang¹ and Zhi-Qian Lu²

Journal of Cardiothoracic Surgery (2016) 11:125

The objective was to **compare** safety and efficacy between **MIDCAB** and **PCI for LAD**.

Fourteen studies with 941 patients were finally involved in the present study.



MACE \geq 1 year

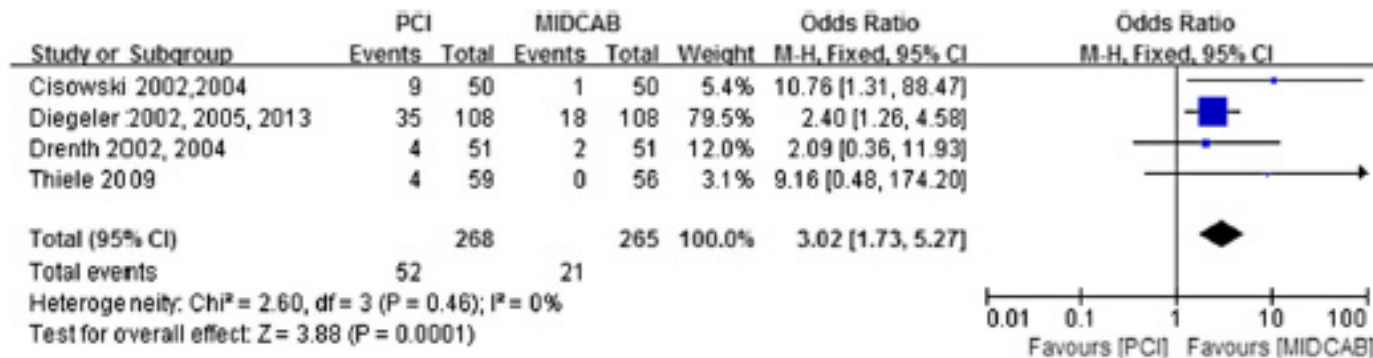


Fig. 8 Comparison of PCI versus MIDCAB for the outcome of restenosis in target vessel at 30 days, 6 months, and beyond 1 year follow-up. PCI, percutaneous coronary intervention; MIDCAB, minimally invasive direct coronary artery bypass

- Compared with PCI, MIDCAB decreased incidence of TVR and MACE at 6 months and beyond 1 year follow-up.
- MIDCAB was associated with a lower incidence of angina recurrence at 6 months compared with PCI. PCI was associated with higher risk of restenosis in target vessel. No significant difference was shown for stroke
- MIDCAB is superior to PCI for TVR and MACE.

Hybrid Coronary Revascularization for the Treatment of Multivessel Coronary Artery Disease



A Multicenter Observational Study

John D. Puskas, MD,^{a,b} Michael E. Halkos, MD,^c Joseph J. DeRose, MD,^d Emilia Bagiella, PhD,^e

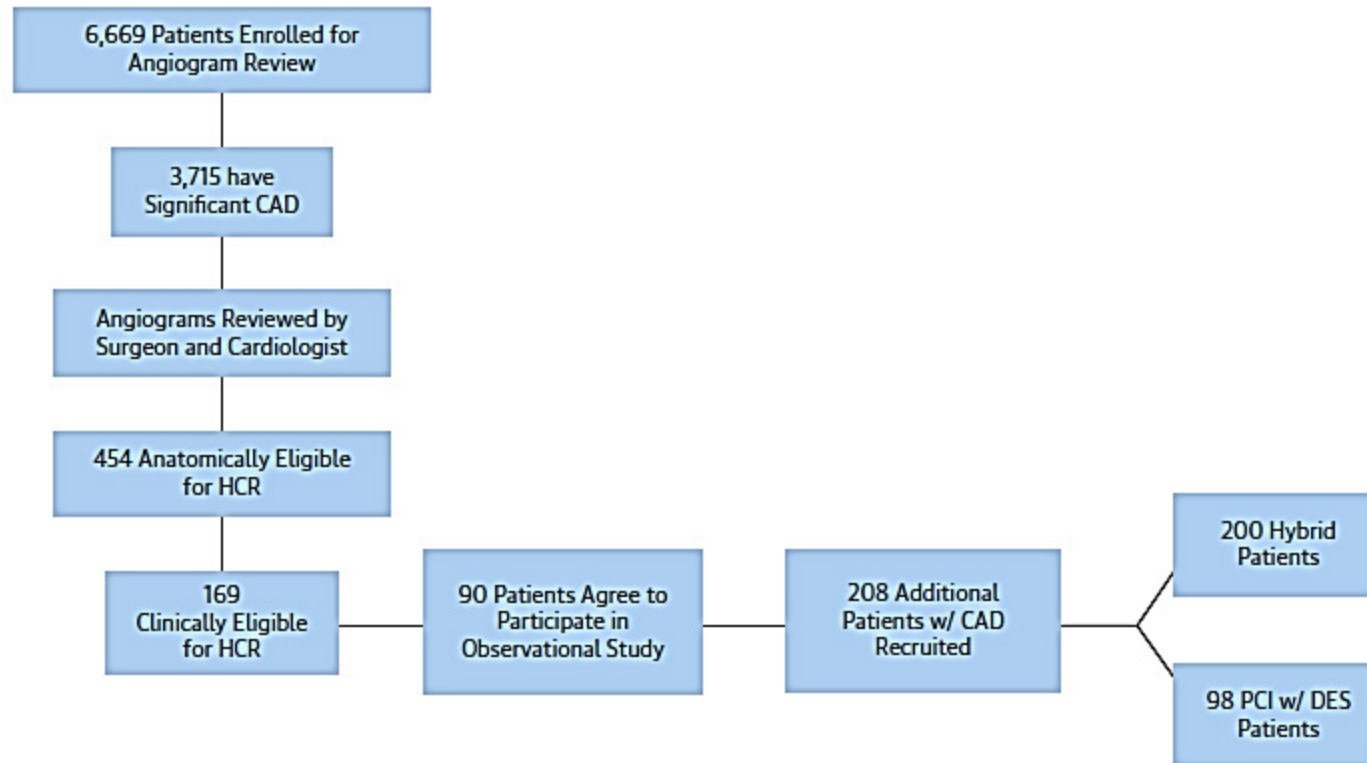
BACKGROUND

Hybrid coronary revascularization (HCR) combines minimally invasive surgical **coronary artery bypass grafting of the left anterior descending artery with percutaneous coronary intervention (PCI) of non-left anterior** descending vessels. HCR is increasingly used to treat multivessel coronary artery disease that includes stenoses in the proximal left anterior descending artery and at least 1 other vessel, but its effectiveness has not been rigorously evaluated.

OBJECTIVES

This National Institutes of Health–funded, multicenter, observational study was **conducted to explore the characteristics and outcomes of patients undergoing clinically indicated HCR and multivessel PCI for hybrid-eligible** coronary artery disease, to inform the design of a confirmatory comparative effectiveness trial.

FIGURE 1 Study Flowchart



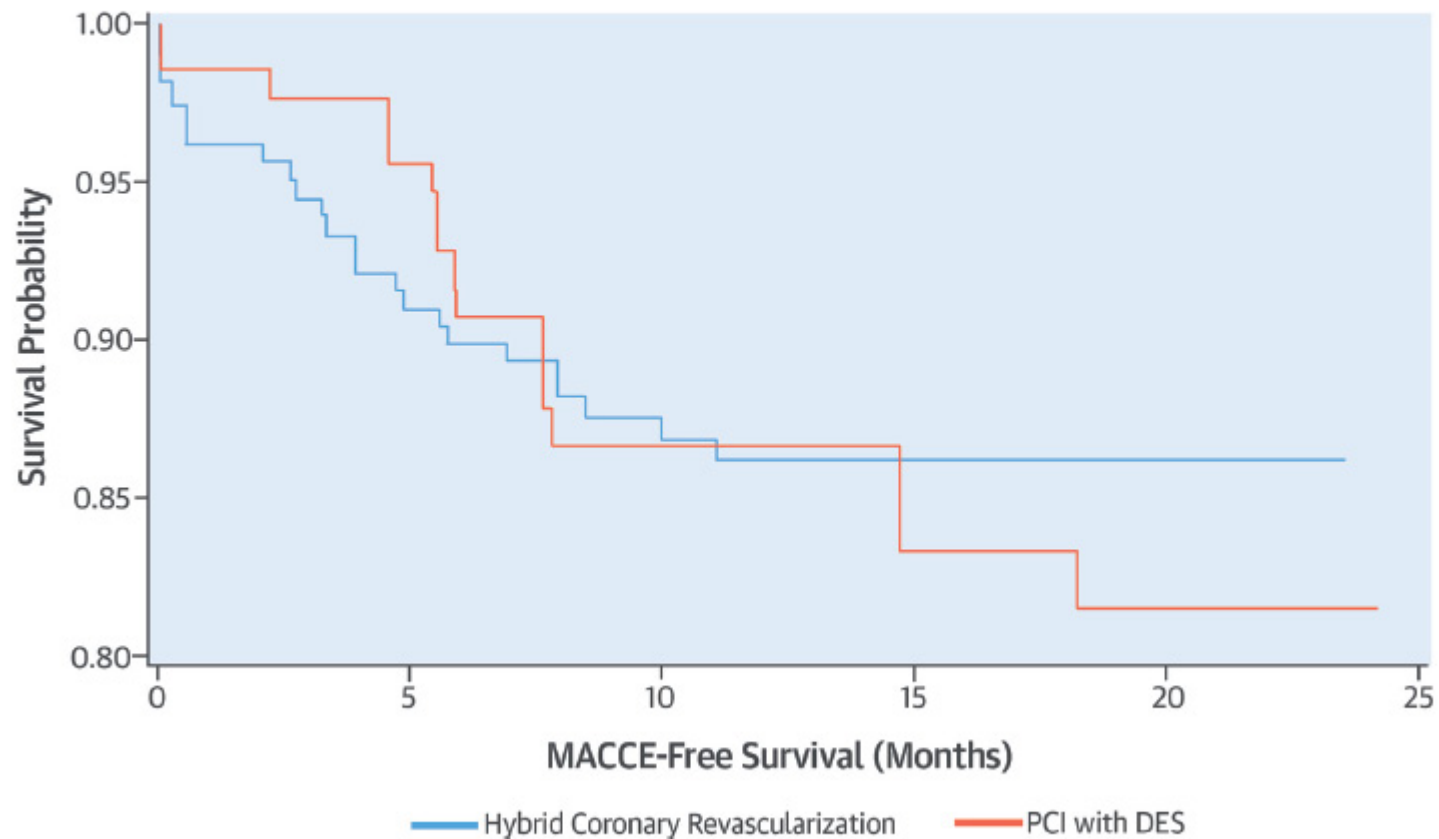
Ninety of the patients from the angiogram screening cohort were combined with 208 patients with hybrid coronary revascularization (HCR)-eligible coronary artery disease (CAD) treated with either HCR or multivessel percutaneous coronary intervention (PCI) to compose the 298 patients who consented to be enrolled in this observational clinical study. Of those 298 enrolled patients, 200 were treated with HCR and 98 were treated with multivessel PCI at the discretion of local cardiologists and surgeons. DES = drug-eluting stent(s).

TABLE 3 Procedure and Procedure Staging

	HCR (n = 200)	PCI With DES (n = 98)
Surgical approach to LITA-LAD grafting		
Robotic MIDCAB (robotic ITA harvest with direct anastomosis)	108 (54)	
Robotic TECAB (robot used for ITA harvest and anastomosis)	42 (21)	
MIDCAB (small left thoracotomy with direct ITA harvest and anastomosis)	38 (19)	
Sternotomy (planned)	12 (6)	
Cardiopulmonary bypass used	32 (16)	
Hybrid procedures: staging of surgery and initial PCI		
Surgery followed by PCI	110 (55.0)	2 (2.0)
PCI followed by surgery	43 (21.5)	0 (0.0)
Simultaneous surgery and PCI	24 (12.0)	0 (0.0)
Surgery only	16 (8.0)	0 (0.0)
Surgery and PCI completed on same day (order unknown)	7 (3.5)	0 (0.0)
PCI-only procedure staging		
Single PCI procedure	0 (0.0)	63 (64.3)
2 PCI procedures	0 (0.0)	30 (30.6)
3 PCI procedures	0 (0.0)	3 (3.1)

CENTRAL ILLUSTRATION Multicenter HCR Study: MACCE-Free Survival at End of Study Follow-Up

MACCE-Free Survival at End of Study Follow-up



Puskas, J.D. et al. *J Am Coll Cardiol.* 2016;68(4):356-65.

In this first multicenter observational study of HCR and multivessel PCI for patients with hybrid-eligible coronary anatomy, **risk-adjusted MACCE rates were similar between groups through 12 months of followup.**

During longer follow-up, at **18 months**, MACCEfree survival curves for HCR versus PCI began to diverge, with **increasing MACCE in the multivessel PCI group.**

Puskas, J.D. et al. J Am Coll Cardiol.
2016;68(4):356–65.



Minimally invasive direct coronary bypass grafting versus percutaneous coronary intervention for single-vessel disease: a meta-analysis of 2885 patients[†]

Antje-Christin Deppe^{a,*†}, Oliver J. Liakopoulos^{b,†}, Elmar W. Kuhn^{a,†}, Ingo Slottosch^a, Maximilian Scherner^a, Yeong-Hoon Choi^{a,c}, Parwis B. Rahmanian^a and Thorsten Wahlers^a

European Journal of Cardio-Thoracic Surgery 47 (2015) 397–406
doi:10.1093/ejcts/ezu285 Advance Access publication 6 August 2014

A total of 2885 patients from 12 studies (6 RCTs, 6 OTs) were identified after a literature search of major databases using a predefined list of keywords. PCI of the LAD was performed in 60.7% (n = 1751) and MIDCAB in 39.3% of patients (n = 1126).

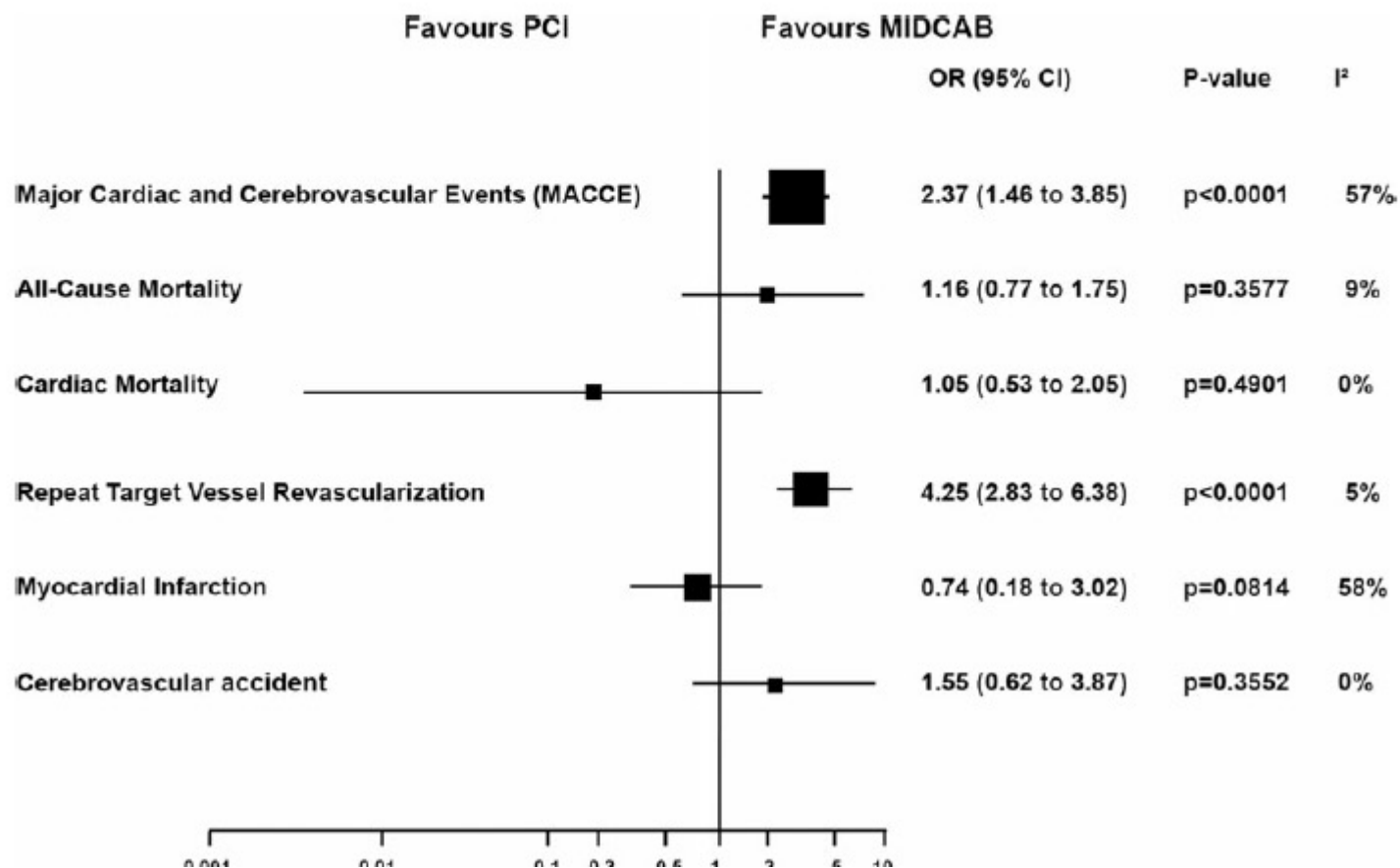
Table 3: Analysed clinical outcomes among groups from all included studies (n = 12)

Dichotomous	Sample size (n)	Prevalence % (n)	PCI % (n)	MIDCAB % (n)	OR (95% CI)	χ^2 test (P-value)
MACCE	2563	3.0% (78)	3.5% (55)	2.4% (23)	1.52 (0.92–2.52)*	0.1535
Death	2562	0.6% (16)	0.8% (12)	0.4% (4)	1.47 (0.52–4.14)**	0.4212
Cardiac death	1648	0.2% (4)	0.3% (3)	0.1% (1)	1.26 (0.25–6.49) [†]	0.8440
TVR	2397	1.7% (41)	2.2% (33)	0.9% (8)	2.11 (1.00–4.47) ^{††}	0.0295
Myocardial infarction [‡]	2397	3.7% (88)	4.2% (64)	2.7% (24)	1.06 (0.65–1.73) [†]	0.0697
CVA	1967	0.9% (17)	0.8% (11)	0.9% (6)	0.89 (0.32–2.46) ^{††}	>0.9999
Continuous	Sample size (n)	WMD			95% CI	Overall effect (P-value)
ICU stay (days)	1530	-1.03			-1.68--0.39	0.0018 [#]
LH (days)	2233	-3.37			-4.92--1.81	<0.0001 ^{##}

In-hospital/30-day follow-up.

Table 4: MACCEs among groups from all included studies (n = 12)

Follow-up	Sample size (n)	Prevalence % (n)	PCI % (n)	MIDCAB % (n)	OR (95% CI)	χ^2 test (P-value)
30-day	2563	3.0% (78)	3.5% (55)	2.4% (23)	1.52 (0.92–2.52)*	0.1535
6-month	2885	8.5% (245)	10.4% (182)	5.6% (63)	1.98 (1.45–2.69)**	<0.0001
1-year	2885	13.5% (390)	17.6% (308)	7.3% (82)	2.29 (1.47–3.57) [†]	<0.0001
2-year	2885	15.4% (443)	19.5% (342)	8.9% (101)	2.41 (1.88–3.09) ^{††}	<0.0001
5-year	2881	20.2% (581)	24.7% (432)	13.2% (149)	2.45 (1.68–3.57) [†]	<0.0001
10-year	2877	20.4% (587)	24.6% (431)	13.9% (156)	2.35 (1.58–3.49) ^{††}	<0.0001



European Journal of Cardio-Thoracic Surgery 47 (2015) 397–406
 doi:10.1093/ejcts/ezu285 Advance Access publication 6 August 2014

- MIDCAB is associated with a substantial risk reduction of repeat TVR after isolated LAD intervention.
- DESs failed to demonstrate equivalent low TVR incidence rates compared with MIDCAB after long-term follow-up.
- On the other hand, no differences of adverse periprocedural events are revealed
- Although MIDCAB is the more invasive procedure for LAD revascularization, MACCE rates are significantly increased after PCI 6 months after LAD revascularization.
- **The current evidence suggests that MIDCAB is a superior technique for isolated LAD revascularization.**

European Journal of Cardio-Thoracic Surgery 47 (2015) 397–406
doi:10.1093/ejcts/ezu285 Advance Access publication 6 August 2014

MESSAGGIO DALLE EVIDENZE E DALL'ESPERIENZA



BG a. 56 MIDCAB 2009

04/11/2016

- Non emergono dati «forti» di superiorità tra chirurgia coronarica off e on pump
 - Per raggiungere l'ottimizzazione, le tecniche miniinvasive richiedono un training lungo e continuo
- TUTTAVIA**
- In assenza di manipolazione dell'aorta l'incidenza di stroke è < di 1%
 - Le procedure ibride (off-pump e PCI) possono offrire risultati molto positivi soprattutto nei pazienti a maggior rischio di complicanze
 - La rivascolarizzazione chirurgica **SUL RAMO IVA**, se perfetta, è superiore alle tecniche percutanee e può essere effettuata con tecniche miniinvasie