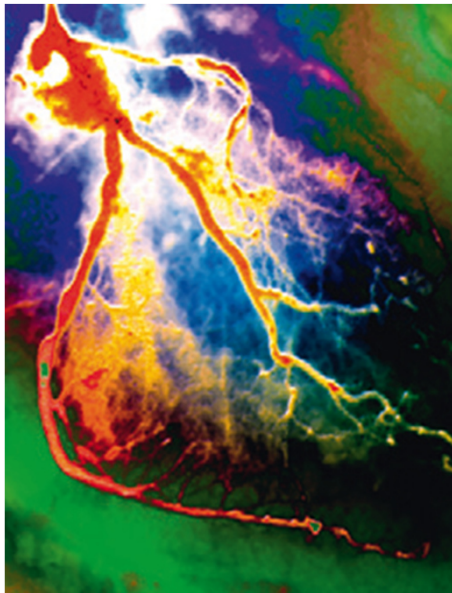


Koronarrevaskularisation: Wann? Wie? Wo? Warum?



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Klinik für Herz-, Thorax- und Gefäßchirurgie, Herzzentrum Lahr

1. Arterielle Koronarrevaskularisation: Wo stehen wir heute?
2. Warum arterielle Revaskularisation?
 - a) das „Versagen“ venöser Bypassgrafts
 - b) Studienlage zur Verwendung arterieller Bypassgrafts (LITA, RITA, BITA, RA)
3. Was sagen die Guidelines?
4. Wie machen wir es am Herzzentrum Lahr ? - „a surgeons view“

1 von 1.000 Patienten mit koronarer Herzerkrankung unterzieht sich einer
koronaren Bypassoperation

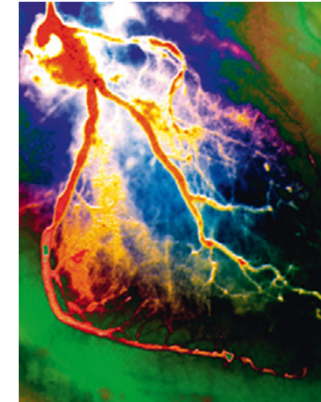
ca. 500.000 koronare Bypassoperationen pro Jahr weltweit

ca. 40.000 isolierte koronare Bypassoperationen in Deutschland

Coronary artery bypass graft surgery versus percutaneous coronary intervention in patients with three-vessel disease and left main coronary disease: 5-year follow-up of the randomised, clinical SYNTAX trial

Friedrich W Mohr, Marie-Claude Morice, A Pieter Kappetein, Ted E Feldman, Elisabeth Stähle, Antonio Colombo, Michael J Mack, David R Holmes Jr, Marie-angèle Morel, Nic Van Dyck, Vicki M Houle, Keith D Dawkins, Patrick W Serruys

Lancet 2013; 381: 629-38



Ergebnisse von SYNTAX nach 5 Jahren:

CABG verringert signifikant kardiale und cerebrovaskuläre Ereignisse (MACCE):

-26,9% in der CABG Gruppe vs. 37,3% in der PCI Gruppe ($p < 0,0001$):

-kardialer Tod (**5,3%** vs. 9,0%; $p = 0,003$),

-Myokardinfarkt (**3,8%** vs. 9,7%; $p < 0,0001$),

-erneute Revaskularisation (**13,7%** vs. 25,9%; $p < 0,0001$)

-kein signifikanter Unterschied in den Todesfällen (all-cause) (11,4% vs 13,9%; $p = 0,10$) oder Schlaganfall (3,7% vs. 2,4%: $p = 0,09$).

Interpretation CABG should remain the standard of care for patients with complex lesions (high or intermediate SYNTAX scores). For patients with less complex disease (low SYNTAX scores) or left main coronary disease (low or intermediate SYNTAX scores), PCI is an acceptable alternative. All patients with complex multivessel coronary artery disease should be reviewed and discussed by both a cardiac surgeon and interventional cardiologist to reach consensus on optimum treatment.

CABG or stents in coronary artery disease: end of the debate?

Will the SYNTAX trial finally end the perennial debate of CABG or PCI for severe coronary artery disease?

It should but, for the wrong reasons, may not. Interventional cardiologists will argue that they could potentially achieve better results with newer generation stents while surgeons emphasise better long-term outcomes of CABG with more arterial grafts.

David P Taggart, Lancet 2013

„Wir versorgen unsere Patienten immer voll arteriell.“

„Total arterielle Revaskularisation (TAR)“

„Die Realität“

Verwendung BITA (linke und rechte Brustwandarterie):

USA 4,4% (2011) *

Deutschland 21,1% (2011) **

UK ca. 15% (2011)

Europa ca. 10% (2011)

Australien ca. 11% (2011)

Verwendung RA:

in USA 9%: RA zweithäufigst verwendetes arterielles Graft nach der LITA *

(bei < 15% aller Bypassoperationen Verwendung von mehr als einem arteriellen Graft)

Deutschland 8,3% (2011) **

* STS Database 2011

**AQUA, Benchmarkreport 2011



„Achillesferse“ von venösen Bypassgrafts:
deren unbefriedigende Prognose

innerhalb des 1. Jahres 10-20% verschlossen

innerhalb des 2.-5. Jahres weitere 5-10% verschlossen

innerhalb des 6.-10. Jahres weitere 20-25% verschlossen

nach 10 Jahren 50 % verschlossen, von den offenen Grafts sind 50 % stenosiert

Sabik et al., Ann Thorac Surg 79: 544-551, 2005

Fitzgibbon et al., J Am Coll Cardiol 28:616-626, 1996

Chesebro et al., N Engl J Med 310: 209-214, 1984

Bourassa et al., Circulation 72:V71-V78, 1985

Campeau et al., Circulation 60:1-5, 1979



Unbefriedigende Prognose von venösen Bypassgrafts

15% Verschlussrate nach 2 Wochen ¹

40-50% Verschlussrate nach 1 Jahr ²

¹ Peykar, S. et al., Minerva Cardioangiol 52:379-390: 2004

² Mehta, R.H. et al., Circulation 124(3):280-288, 2011

LITA

>90 % Offenheitsrate nach 10 Jahren

LITA ist der Goldstandard für die Revaskularisation der LAD

Loop et al., N Engl J Med 314: 1-6, 1986

Acinapura et al., Ann Thorac Surg 48: 186-191, 1989

Cameron et al., N Engl J Med 334: 216-219, 1996

Sabik et al., Ann Thorac Surg 76: 1490-1496, 2003

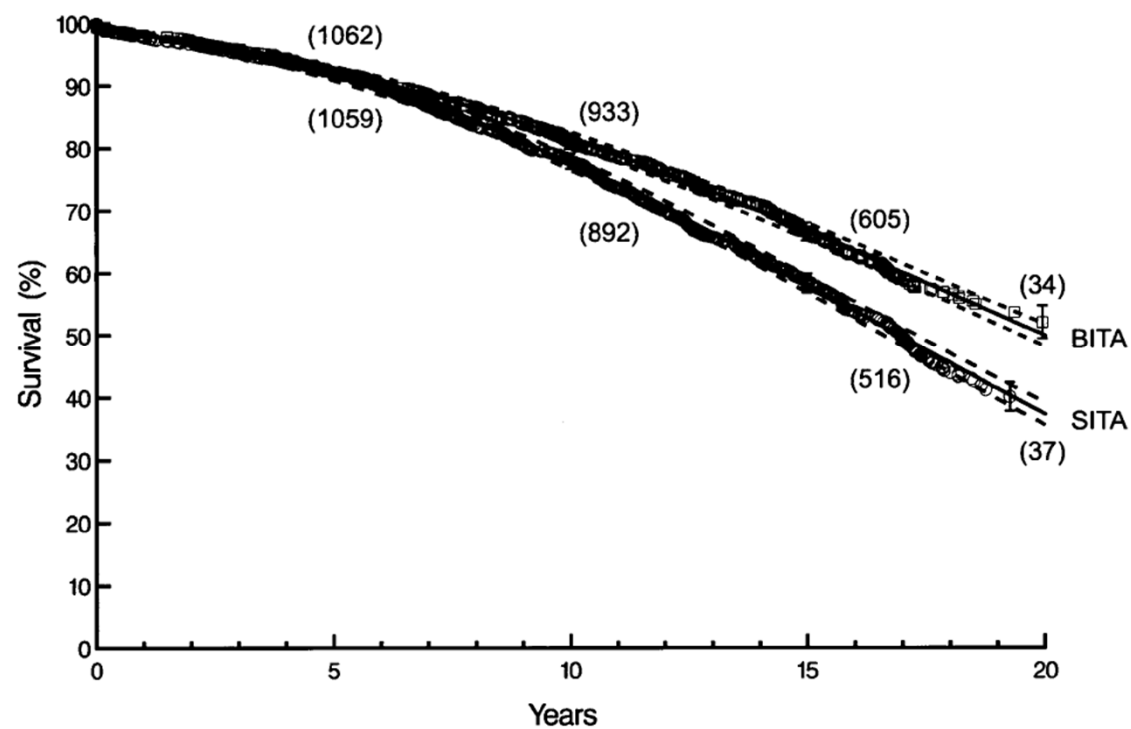
Beide Brustwandarterien ?

The Effect of Bilateral Internal Thoracic Artery Grafting on Survival During 20 Postoperative Years

Bruce W. Lytle, MD, Eugene H. Blackstone, MD, Joseph F. Sabik, MD,
Penny Houghtaling, MS, Floyd D. Loop, MD, and Delos M. Cosgrove, MD

Departments of Thoracic and Cardiovascular Surgery, and Biostatistics and Epidemiology, The Cleveland Clinic Foundation,
Cleveland, Ohio

Ann Thorac Surg 2004;78:2005-14



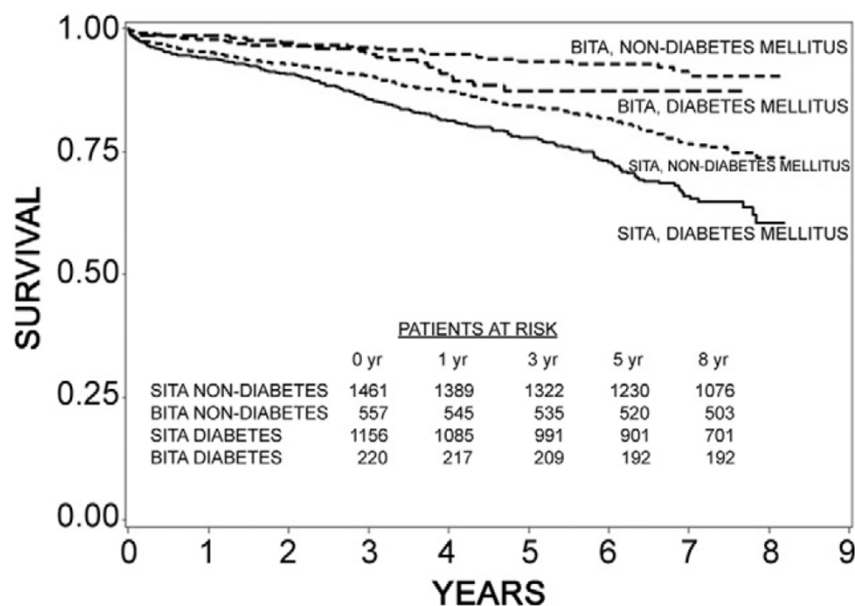
Beide Brustwandarterien bei Diabetes ?

Bilateral Internal Thoracic Artery Grafting Is Associated With Significantly Improved Long-Term Survival, Even Among Diabetic Patients

John D. Puskas, MD, Adil Sadiq, MS, MCh, Thomas A. Vassiliades, MD, Patrick D. Kilgo, MS, and Omar M. Lattouf, MD, PhD

Clinical Research Unit, Division of Cardiothoracic Surgery and Department of Biostatistics and Bioinformatics, Rollins School of Public Health, Emory University, Atlanta, Georgia

Ann Thorac Surg 2012;94:710–6



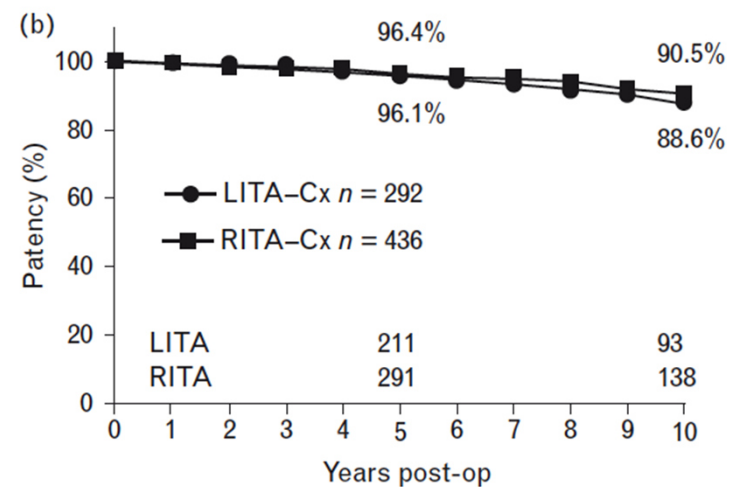
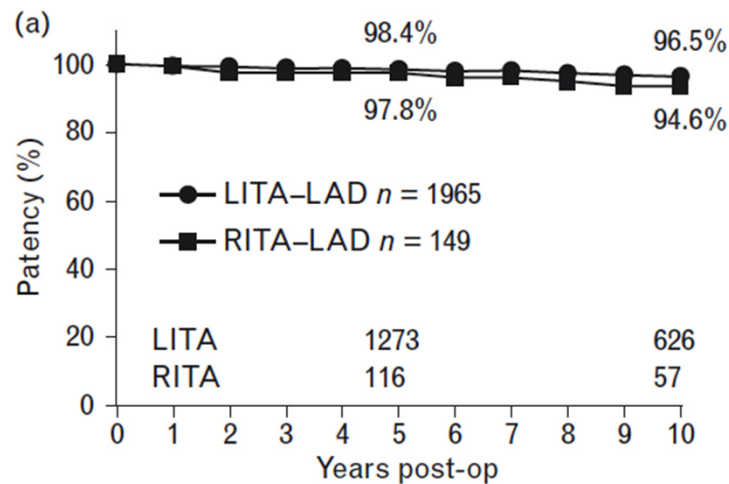
and risk of DSWI before electing to use BITA. Our present practice is generally to use BITA grafting selectively in patients who are aged younger than 75 years, have suitable coronary artery targets, are not morbidly obese, and whose glycosylated hemoglobin level is less than 7% [14]. Skeletonized harvest of BITA conduits is preferred, especially in diabetic patients.

Offenheitsraten RITA-Grafting

90 % Offenheitsrate nach 10 Jahren (in den meisten Studien skelettiert, exzellente Offenheitsraten gelten auch für RITA's mit Pedikel)

Fukui et al., J Thorac Cardiovasc Surg 139: 868-873, 2010 (705 RITA Grafts)

Tatoulis et al., Ann Thorac Surg 92: 9-17, 2011 (991 RITA Grafts)



Tatoulis et al.

Freies RITA-Grafting

Exzellente und mit in situ vergleichbare Offenheitsraten für freie RITA
(insetiert in die Aorta ascendens oder als T/Y-Graft)

Fukui et al., J Thorac Cardiovasc Surg 139: 868-873, 2010

Tatoulis et al., Ann Thorac Surg 92: 9-17, 2011

Cho et al., Ann Thorac Surg 90: 744-752, 2010

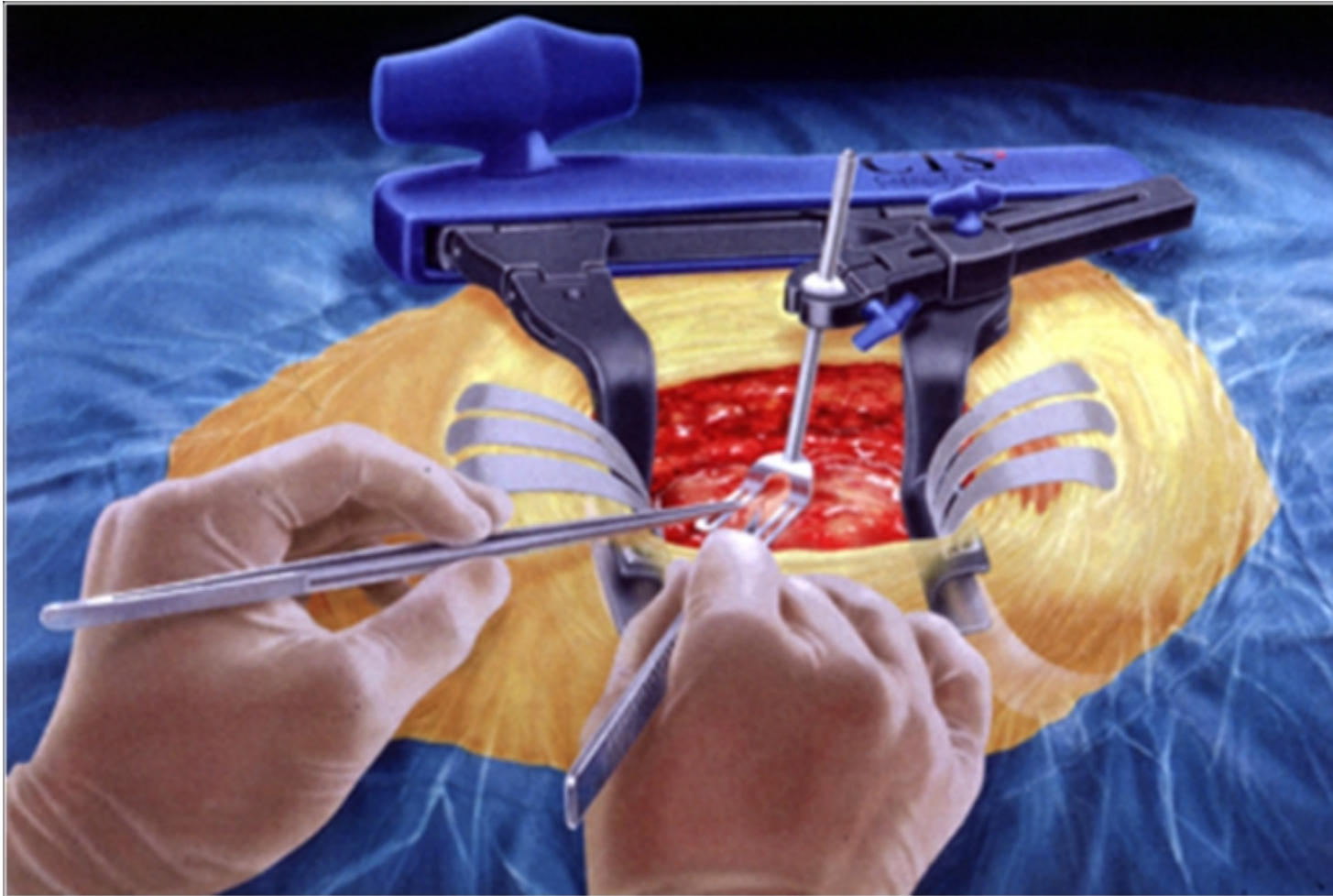
Warum verwenden Herzchirurgen weltweit nur selten beide Brustwandarterien?

- „Angst“ vor tiefen Sternuminfektionen, Mediastinitis
- die tiefe Sternuminfektion trifft den Herzchirurgen „jetzt und hart“
- der Benefit der BITA ist für den Chirurgen „unsichtbar und liegt weit in der Zukunft“
- BITA „technisch sehr anspruchsvoll und zeitintensiver“

Warum BITA-Grafting am Herzzentrum Lahr ?

- die perioperative Mortalität und Morbidität ist sehr gering, vergleichbar mit CABG (LITA/SVG)
- die Inzidenz von tiefen Sternuminfektionen (DSWI) ist niedrig (1-3%), insbesondere wenn die ITA's skelettiert entnommen werden
- RITA Offenheitsraten (egal ob in situ, freies Graft, Composite Graft) sind exzellent und vergleichbar mit LITA

Bypassoperation ohne Herz-Lungen-Maschine am HZL



Bypassoperation ohne Herz-Lungen-Maschine am HZL

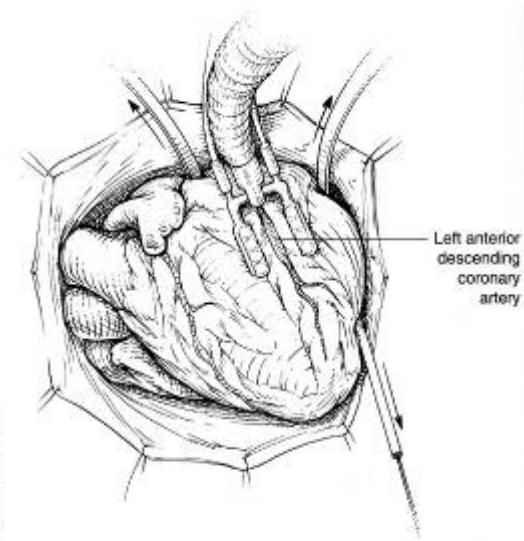
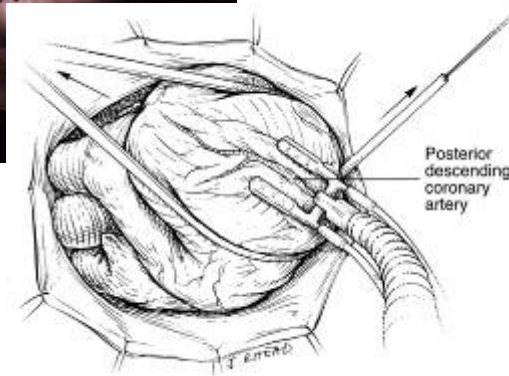
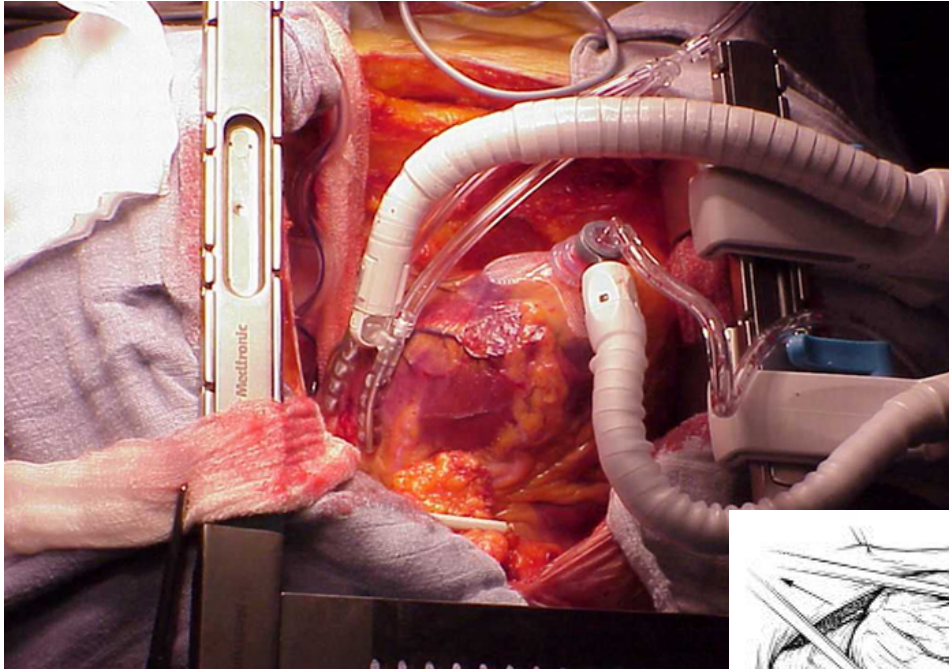
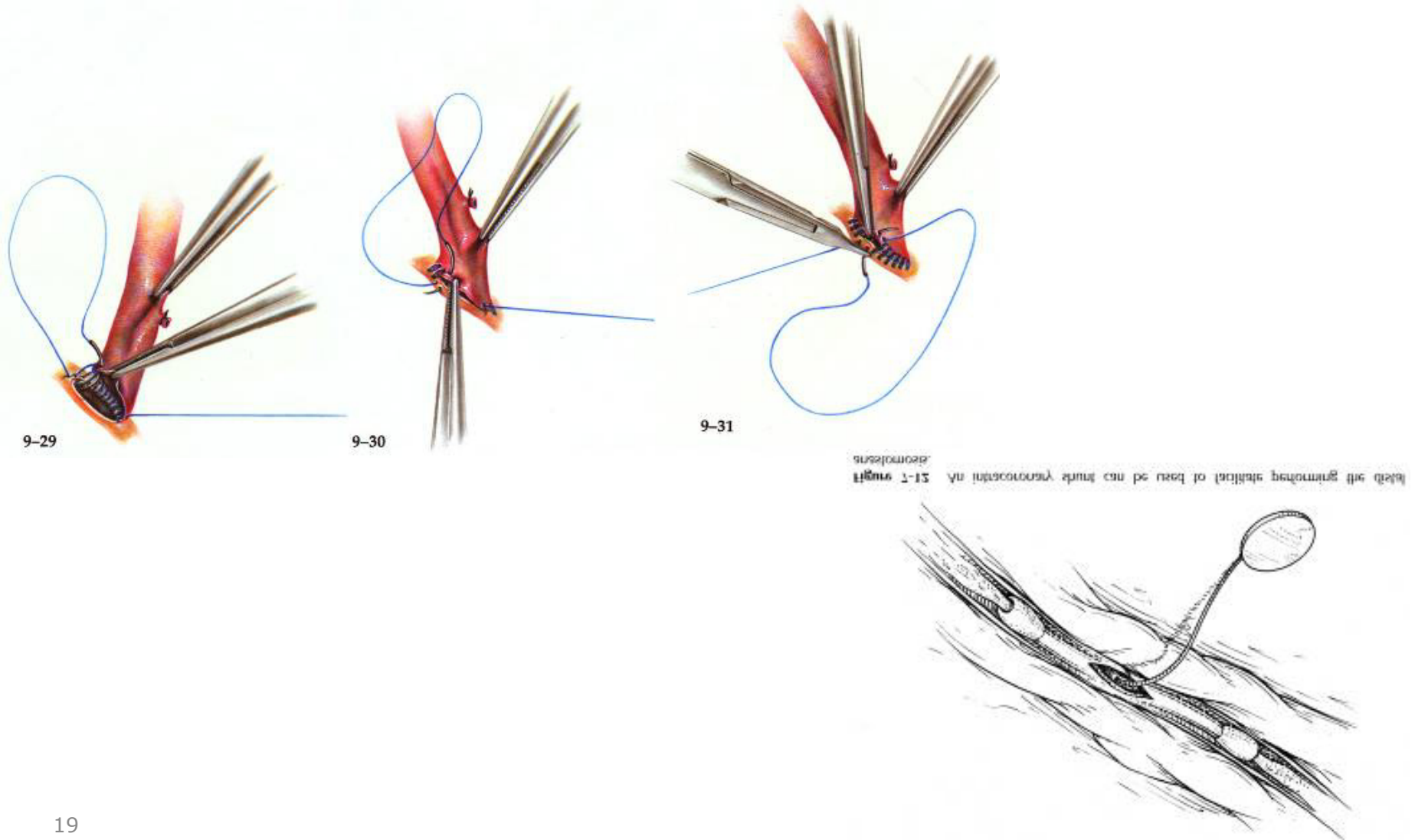
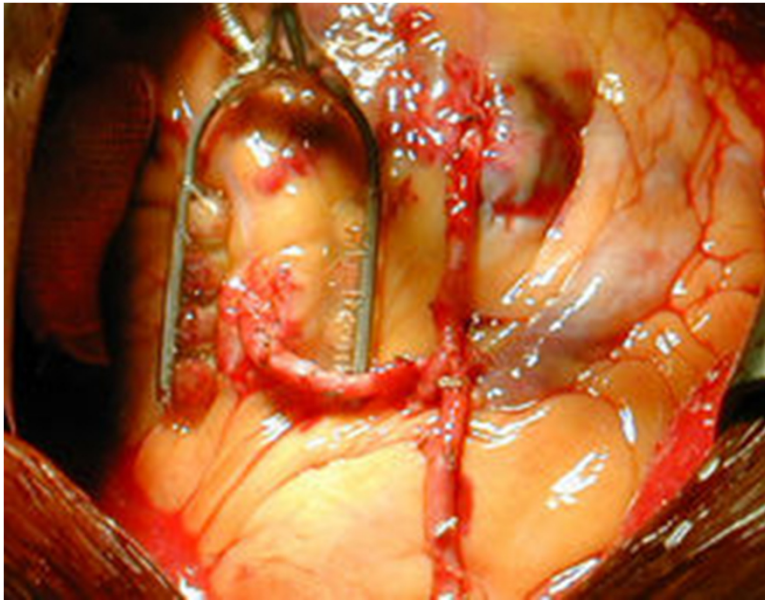


Figure 7-11 Exposure of posterior and anterior descending coronary arteries. **A**, Posterior descending coronary artery. Heart is elevated with minimal lateral displacement by upward traction toward the head on ends of tape and downward traction on the snare. A stabilizing device is then applied. **B**, Anterior descending coronary artery. Ends of tape are pulled upward and slightly to patient's left, and downward traction in the opposite direction is exerted on the snare. A stabilization device is then applied.

Bypassoperation ohne Herz-Lungen-Maschine am HZL

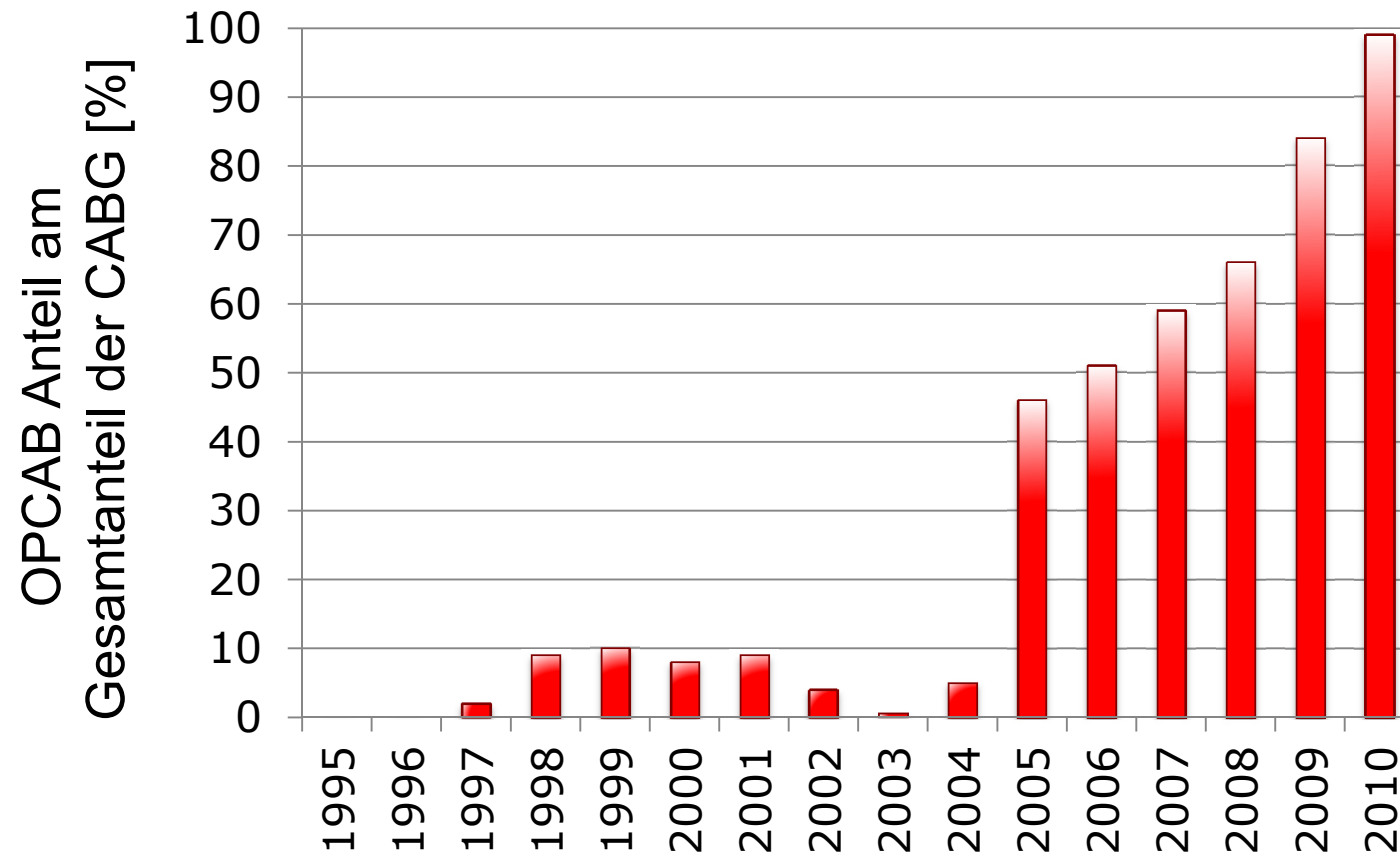


Bypassoperation ohne Herz-Lungen-Maschine am HZL



Bypasschirurgie am schlagenden Herzen (OPCAB)

OPCAB-Anteil 2014 u. 2015 liegt bei > 80%



Five-Year Outcomes after Off-Pump or On-Pump Coronary-Artery Bypass Grafting



The NEW ENGLAND
JOURNAL of MEDICINE

The New England Journal of Medicine 2016;375:2359-2368

- 4752 Patienten aus 19 Ländern (randomisiert)
- Endpunkte: Tod, Schlaganfall, Myokardinfarkt, Nierenversagen, Re-Intervention

- Ergebnis:

In our trial, the rate of composite outcome of death, stroke, myocardial infarction, renal failure,, or repeat revascularisation at 5 years follow-up was similar among patients who underwent off-pump CABG and those who underwent on-pump CABG

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 for Percutaneous Cardiovascular Interventions (EAPCI)[‡]

European Heart Journal (2010) **31**, 2501–2555

Table 32 Technical recommendations for coronary artery bypass grafting

| | Class ^a | Level ^b | Ref. ^c |
|---|--------------------|--------------------|------------------------|
| Procedures should be performed in a hospital structure and by a team specialized in cardiac surgery, using written protocols. | I | B | 192, 196 |
| Arterial grafting to the LAD system is indicated. | I | A | 194 |
| Complete revascularization with arterial grafting to non-LAD coronary systems is indicated in patients with reasonable life expectancy. | I | A | 49, 194, 196, 197, 199 |
| Minimization of aortic manipulation is recommended. | I | C | — |
| Graft evaluation is recommended before leaving the operating theatre. | I | C | — |

^aClass of recommendation.

^bLevel of evidence.

^cReferences.

LAD = left anterior descending.

10.2.2 Bypass graft

The long-term benefit of CABG is maximized with the use of arterial grafts, specifically the ITA.¹⁹⁴ Available grafts include internal thoracic, radial, and gastro-epiploic arteries. All except the radial artery can remain connected to their anatomical inflow or be used as free graft, with the aorta or another graft as inflow.

The side-to-side anastomosis used in arterial and venous grafting eliminates an aortic anastomosis, decreases the amount of graft required, and increases total graft flow. The latter factor contributes to a higher patency rate. Partially or total ITA skeletonization increases its length and possibility of use. Rates of sternal wound infection and angiographic results are similar whether ITA is skeletonized or not. These techniques may allow a complete arterial revascularization.

Use of bilateral ITA is associated with higher post-operative sternal dehiscence and increased rate of mediastinitis in obese and possibly diabetic patients.¹⁹⁵ But event-free long-term survival, reduced risk of recurrent angina or MI, and reduced need for re-operation correlate well with the extensive use of arterial grafts.^{49,196,197}

Using radial artery grafts increases the number of arterial anastomoses beyond the use of both ITAs. At 5 years, patency rates of radial artery are possibly superior to saphenous grafts but certainly inferior to ITA. This patency is strongly related to target vessel size and stenosis severity.

Graft flow measurement, related to graft type, vessel size, degree of stenosis, quality of anastomosis, and outflow area, is useful at the end of surgery. Flow <20 mL/min and pulsatility index >5 predict technically inadequate grafts, mandating graft revision before leaving the operating theatre.¹⁹⁸

Table 32 lists the evidence-based technical recommendations for CABG.

PRACTICE GUIDELINE

2011 ACCF/AHA Guideline for Coronary Artery Bypass Graft Surgery

A Report of the American College of Cardiology Foundation/
American Heart Association Task Force on Practice Guidelines

*Developed in Collaboration With the American Association for Thoracic Surgery,
Society of Cardiovascular Anesthesiologists, and Society of Thoracic Surgeons*

2.1.4. Bypass Graft Conduit: Recommendations

CLASS I

1. If possible, the left internal mammary artery (LIMA) should be used to bypass the left anterior descending (LAD) artery when bypass of the LAD artery is indicated (86–89). (Level of Evidence: B)

CLASS IIa

1. The right internal mammary artery (IMA) is probably indicated to bypass the LAD artery when the LIMA is unavailable or unsuitable as a bypass conduit. (Level of Evidence: C)
2. When anatomically and clinically suitable, use of a second IMA to graft the left circumflex or right coronary artery (when critically stenosed and perfusing LV myocardium) is reasonable to improve the likelihood of survival and to decrease reintervention (90–94). (Level of Evidence: B)

CLASS IIb

1. Complete arterial revascularization may be reasonable in patients less than or equal to 60 years of age with few or no comorbidities. (Level of Evidence: C)
2. Arterial grafting of the right coronary artery may be reasonable when a critical ($\geq 90\%$) stenosis is present (89,93,95). (Level of Evidence: B)
3. Use of a radial artery graft may be reasonable when grafting left-sided coronary arteries with severe stenoses ($>70\%$) and right-sided arteries with critical stenoses ($\geq 90\%$) that perfuse LV myocardium (96–101). (Level of Evidence: B)

CLASS III: HARM

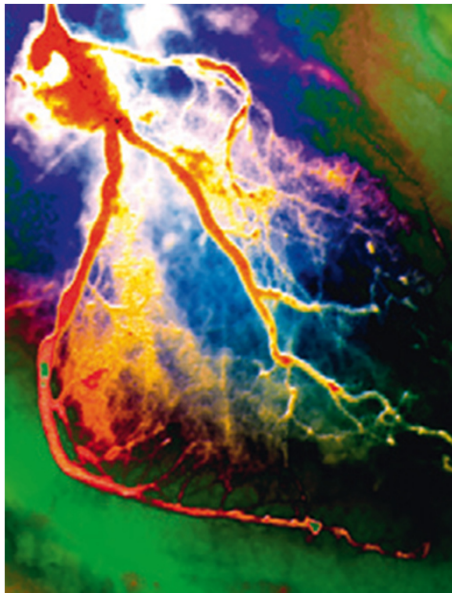
1. An arterial graft should not be used to bypass the right coronary artery with less than a critical stenosis ($<90\%$) (89). (Level of Evidence: C)

So machen wir es am HZL



1. Wir verwenden alle Revaskularisationstechniken (OPCAB, On-Pump, LIMA, RIMA, BITA, RA usw.) und wenden sie individuell für den Patienten an
2. immer LITA zur LAD, „Goldstandard“
3. BITA, wenn immer möglich (skelettierte Präparationsweise der ITA's)
4. wenn BITA nicht möglich (extreme Adipositas, schlecht eingestellter Diabetes mellitus (HbA1c > 7%), Alter > 70 a etc.), verwende RA als Alternative für zweites arterielles Graft
5. RITA und insbesondere RA nur bei Stenosen >75% (Vermeidung konkurrierender Flüsse)
6. Immer erfolgt die intraoperative Flußmessung (keine Kompromisse, insbesondere bei sequentiellen Grafts)
7. SVG in Ausnahmen zur Revaskularisation der RCA geeignet (Stenose < 90% , arterielle Grafts sind der SVG zur Revaskularisation der RCA „wahrscheinlich“ nicht überlegen)
8. Wir versuchen sequentielle Venengrafts zu vermeiden

Vielen Dank!



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