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Preoperative intraaortic balloon counterpulsation in high-risk CABG

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Department of Cardiac and Thoracic Vascular Surgery

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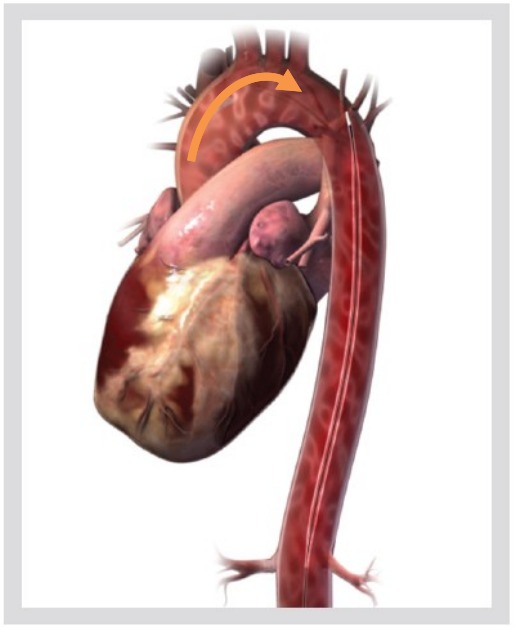
Preoperative IABP in high-risk CABG – Questions?? –

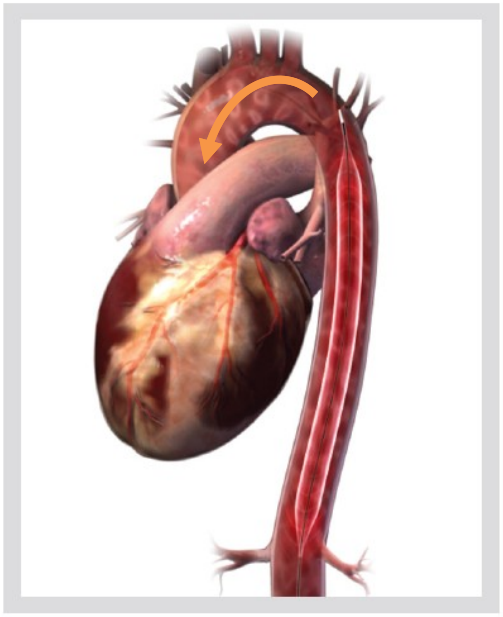
- Useful?
- Definition of “High-risk”?
- Pre-OP/Intra-OP/Post-OP?
- Complication vs Benefit?
- Mortality?
- Morbidity?

Effects of IABC

- Increase cardiac output
- Increase coronary perfusion
- Increase myocardial oxygen supply
- Decrease afterload
- Decrease cardiac work
- Decrease myocardial oxygen consumption



Deflate



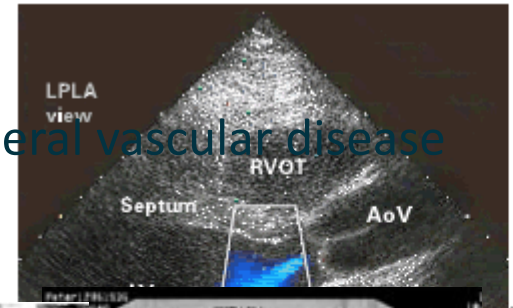
Inflate

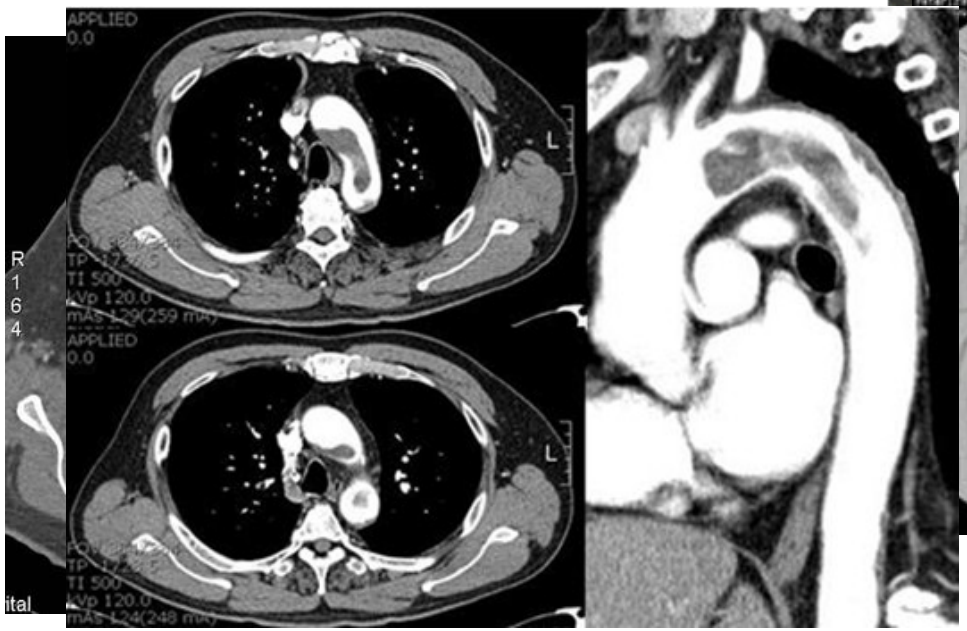
Indications

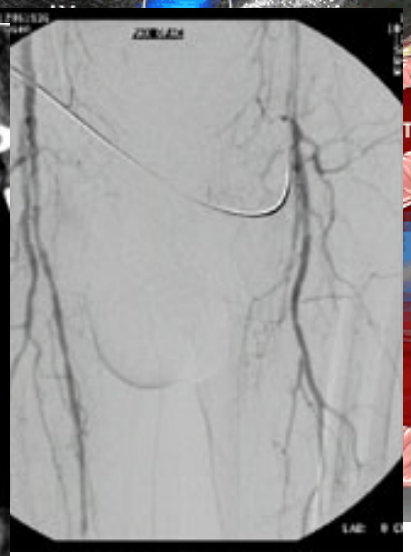
- Cardiac failure after a cardiac surgical procedure
- Refractory angina despite maximal medical management
- Cardiogenic shock/Acute MI
- Mitral regurgitation
- Perioperative treatment of complications due to myocardial infarction
- Failed PTCA
- As a bridge to cardiac transplantation
- **Elective: Prior to high-risk CABG**

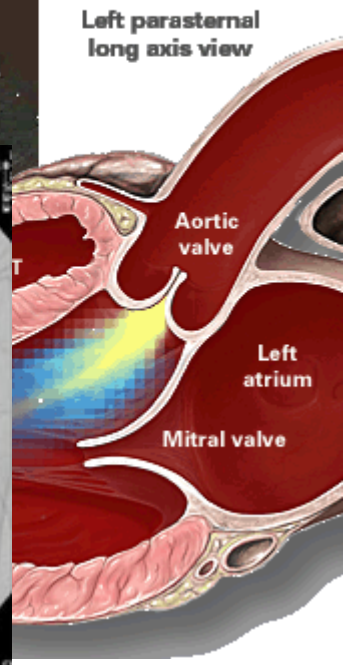
Contraindications

- Severe aortic insufficiency
- Aortic aneurysm (thoracic or abdominal)
- Aortic dissection
- Severe calcific aorta-iliac disease or peripheral vascular disease
- Thromboembolism



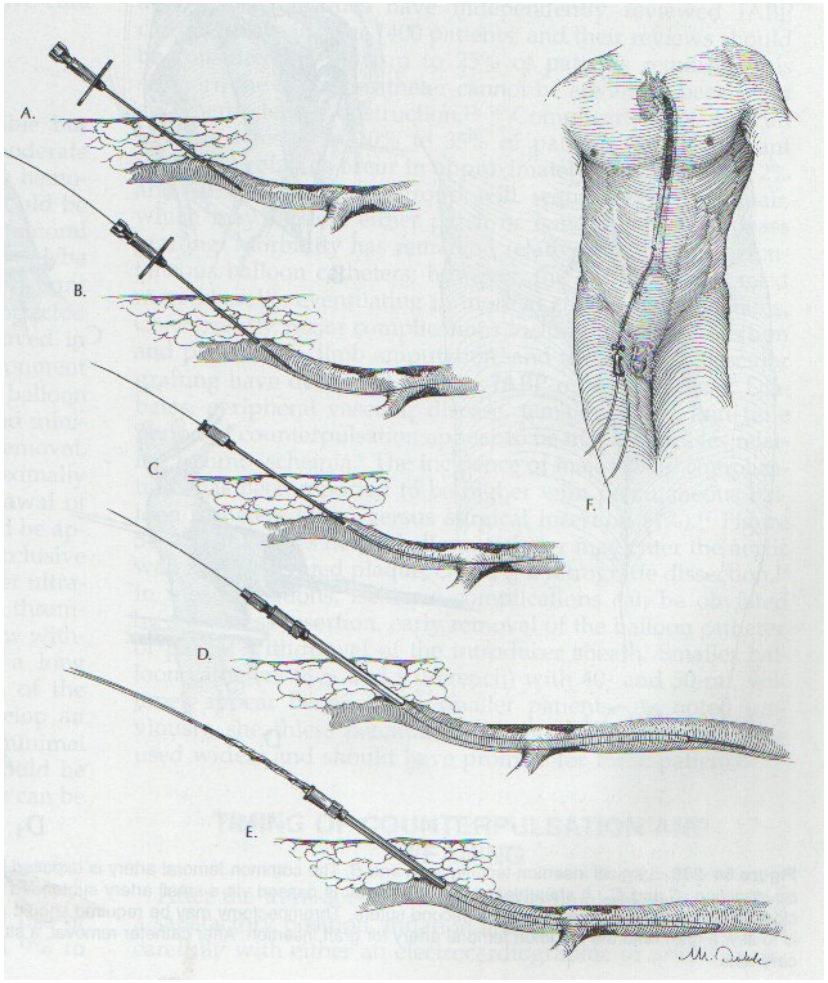






IABP Insertion

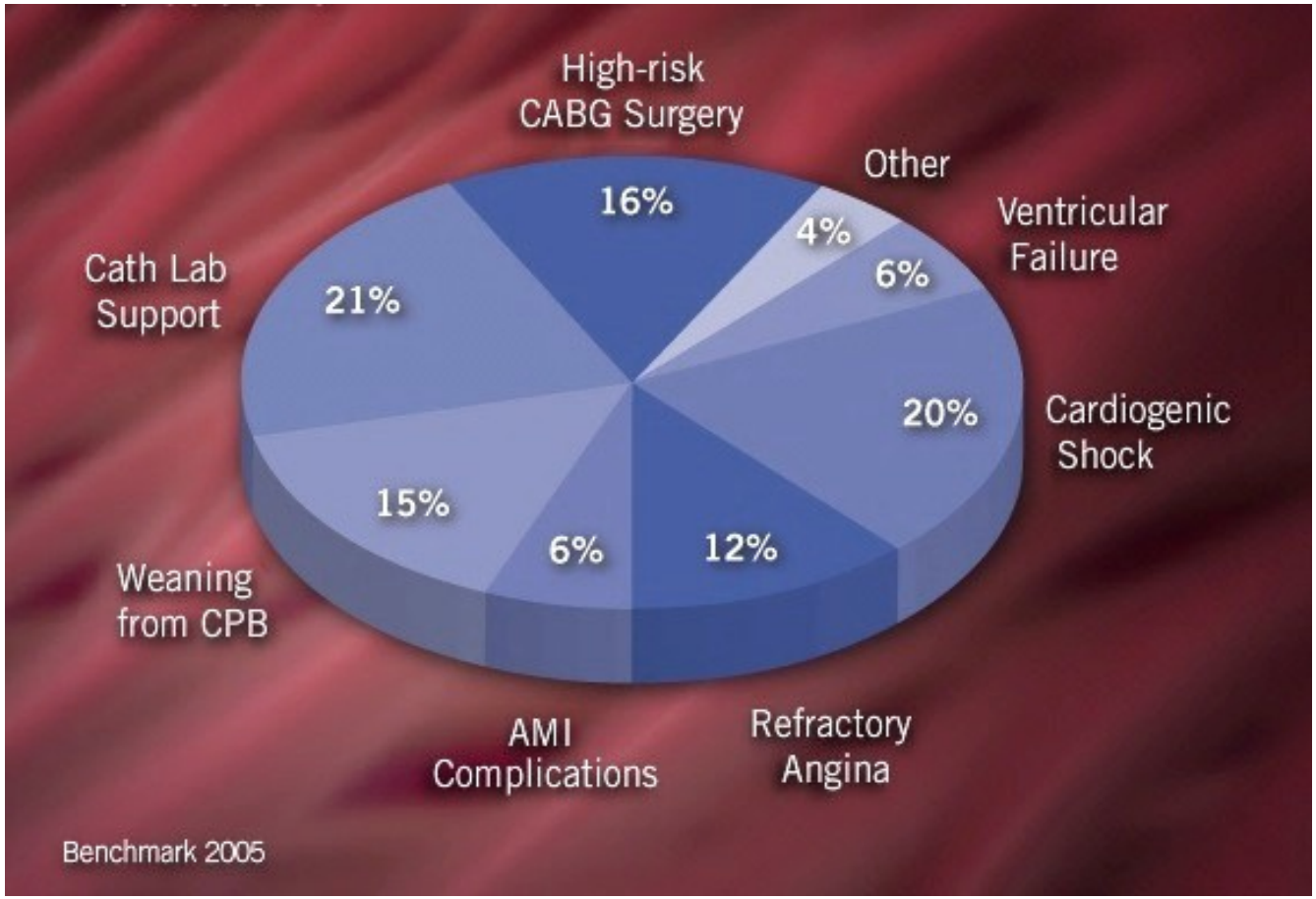
- Percutanous
  - **Sheath less**
- Surgical insertion
  - Femoral cut down
  - Trans-thoracic



IABP Complications

- Limb ischemia
- Thrombosis
- Emboli
- Bleeding at the insertion site
- Groin hematomas
- Aortic perforation and/or dissection
- Renal failure and bowel ischemia
- Neurologic complications including paraplegia
- Infection

IABC Clinical Indications



IABC in High-Risk CABG

- ~700.000 CABG procedures/year
- ~10% high-risk (?)
- No consensus on the definition of high-risk CABG pts.
- Low cardiac output post-CABG: ~2-9%
- No real consensus who may benefit from IABC

- ✓ **low ejection fraction….** ***(how low?)***
- ✓ **advanced age…** ***(how old?)***
- ✓ **left main stenosis….** ***(grade?)***
- ✓ **redo operation**
- ✓ **Unstable angina**
- ✓ **recent myocardial infarction**
- ✓ **New York Heart Association III-IV class**

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IABC in High-Risk CABG **– GUIDELINES –**

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

JACC Vol. 58, No. 24, 2011

CLASS IIa

1. In the absence of severe, symptomatic aorto-iliac or PAD, the insertion of an intraaortic balloon reduce mortality rate in CABG patients who are c high risk (e.g., those who are undergoing reopera <30% or left main CAD) (1021–1026). *(Level of*

1021. Christenson JT, Cohen M, Ferguson JJI, et al. Trends in intraaortic balloon counterpulsation complications and outcomes in cardiac surgery. Ann Thorac Surg. 2002;74:1086–90.
1022. Christenson JT, Simonet F, Badel P, et al. Optimal timing of preoperative intraaortic balloon pump support in high-risk coronary patients. Ann Thorac Surg. 1999;68:934–9.
1023. Christenson JT, Licker M, Kalangos A. The role of intra-aortic counterpulsation in high-risk OPCAB surgery: a prospective randomized study. J Card Surg. 2003;18:286–94.
1024. Christenson JT, Schmuziger M, Simonet F. Effective surgical management of high-risk coronary patients using preoperative intra-aortic balloon counterpulsation therapy. Cardiovasc Surg. 2001;9:383–90.
1025. Urban PM, Freedman RJ, Ohman EM, et al. In-hospital mortality associated with the use of intra-aortic balloon counterpulsation. Am J Cardiol. 2004;94:181–5.
1026. Santa-Cruz RA, Cohen MG, Ohman EM. Aortic counterpulsation: a review of the hemodynamic effects and indications for use. Catheter Cardiovasc Interv. 2006;67:68–77.

Prophylactic IABP Placement – META-ANALYSIS –

- **Pre-Op IABP placement *vs* intra-, post- or no IABP placement**
- **Outcome**
  - Hospital mortality (primary)
  - IABC-related complications (secondary)

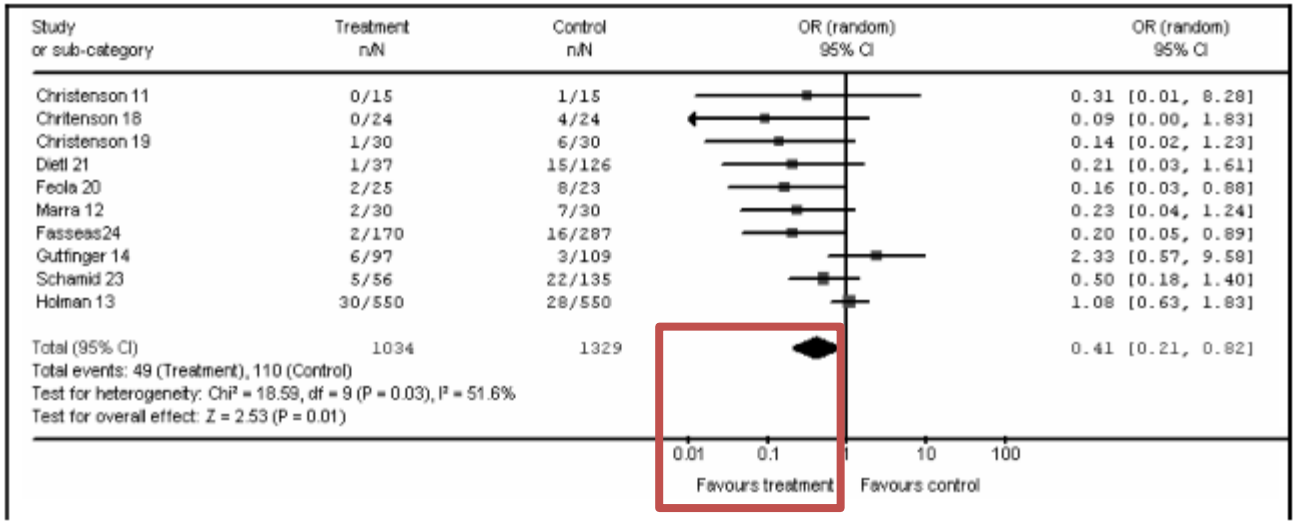


Figure 1. *Meta-analysis of randomized controlled trials and cohort studies, and effect on hospital mortality.*

Dyubet al. J Cardiac Surg 2008;23:79-86

IABC-related complications: 3.7%

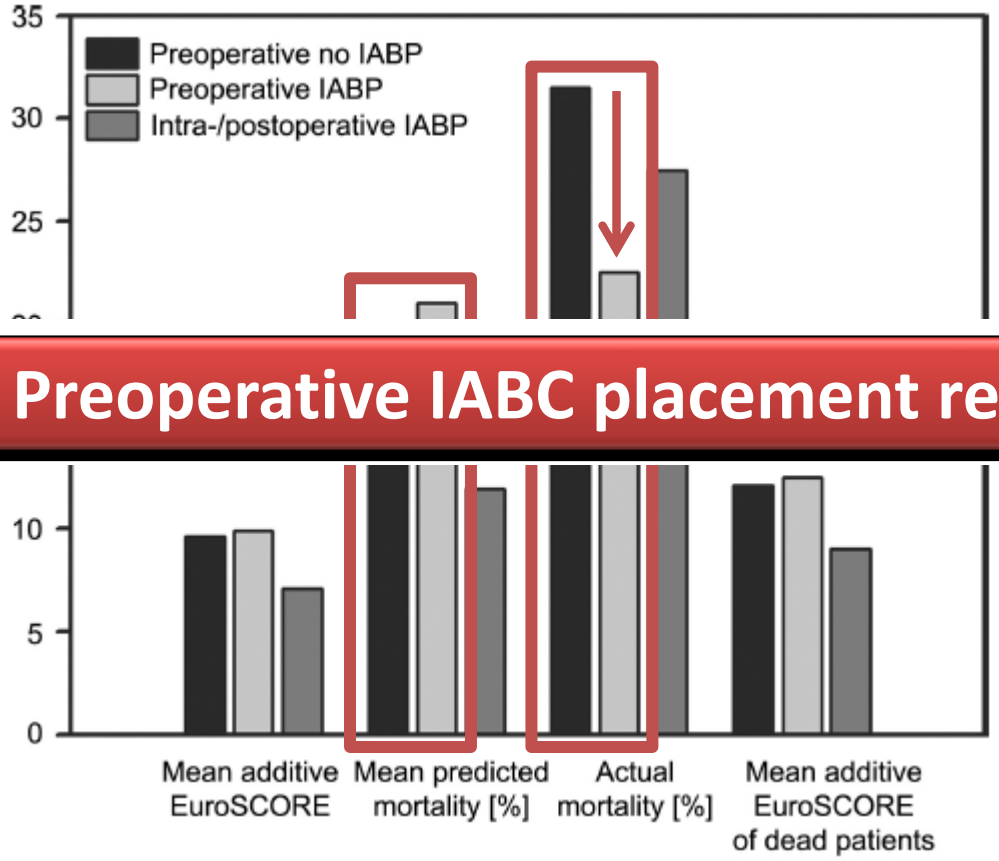
IABC related Mortality: 0%

IABP Placement in high-risk CABG pts. directed by EuroSCORE – SINGLE-CENTER –

- **EuroSCORE developed for prediction of early mortality after cardiac surgery**
- **267 high-risk pts. (EF<40%, unstable angina, left main stenosis + RCA >70%)**
  - No preoperative IABC (92pts)
  - Preoperative IABC (62 pts)
  - Intra- or postoperative IABC (113 pts)

Diez et al. Interactive Cardiovascular and Thoracic Surgery 2008;7:389-397

IABP Placement in high-risk CABG pts. directed by EuroSCORE – SINGLE-CENTER –



→ Preoperative IABC placement reduces mortality

Diez et al. Interactive Cardiovascular and Thoracic Surgery 2008;7:389-397

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Prophylactic IABP Placement in high-risk CABG pts.

– SINGLE-CENTER –

- **141 high-risk CABG pts.**
  - unstable angina
  - EF ≤ 40%
  - left main stenosis ≥ 70%
  - previous CABG
  - 4 or more planned distal anastomosis

- **38 (27%) prophylactic IABC**
- **103 (73%) no pre-OP IABC ⇒ 27 (26%) IABC intra-OP**
  ⇒ 10 (10%) IABC post-OP

Miceli et al. Interactive Cardiovascular and Thoracic Surgery 2009;9:291-5

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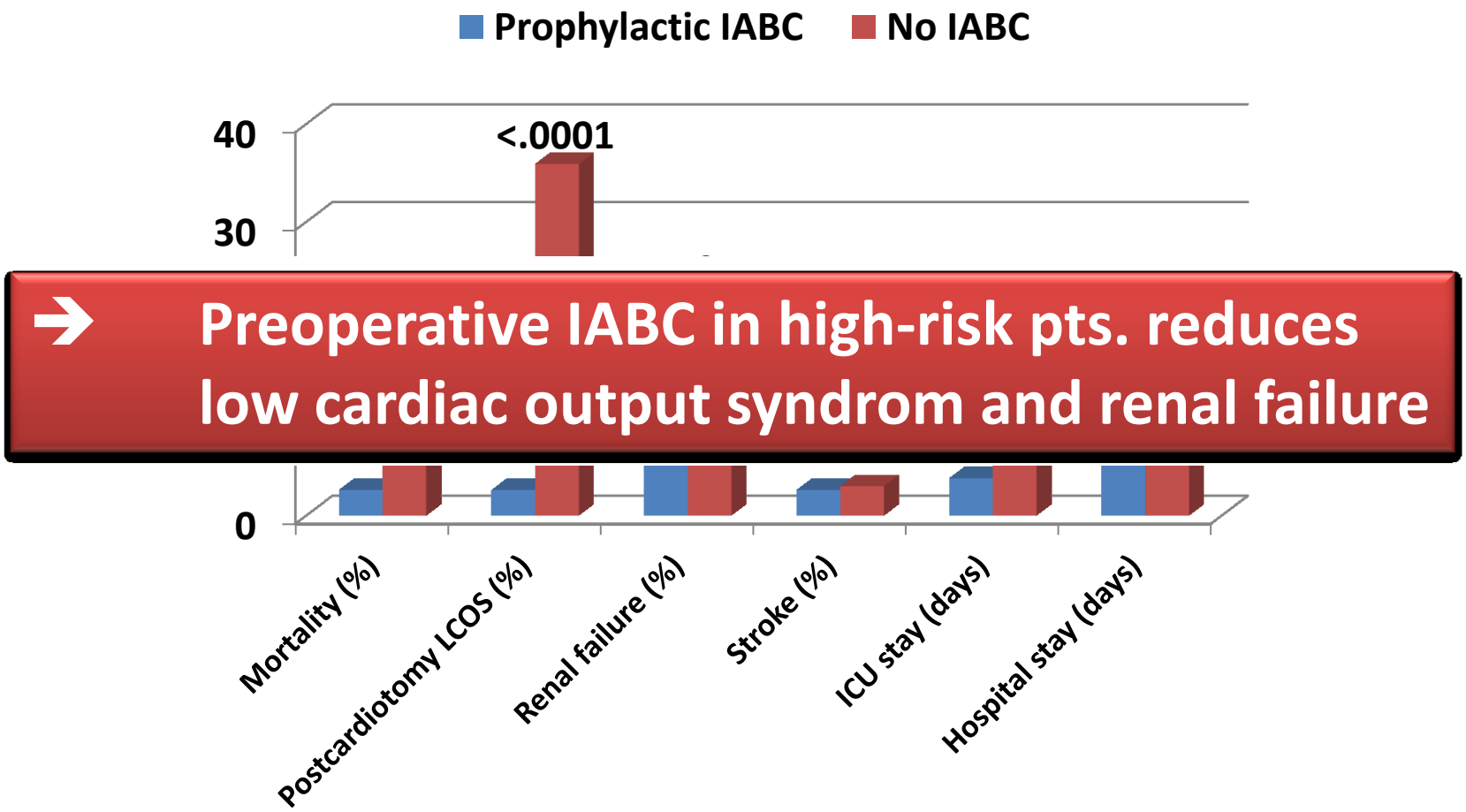
Prophylactic IABP Placement in high-risk CABG pts. – SINGLE-CENTER –



→ **Preoperative IABC in high-risk pts. reduces low cardiac output syndrom and renal failure**

Miceli et al. Interactive Cardiovascular and Thoracic Surgery 2009;9:291-5

Prophylactic IABP Placement in high-risk CABG pts.

– SINGLE-CENTER –

- **111 high-risk CABG pts. with IABC pre-OP**
  - EuroScore >12
- **130 low-risk CABG pts. without IABC**
  - EuroScore <5

Santarpino et al. Ann Thorac Surg 2009;87:481-8

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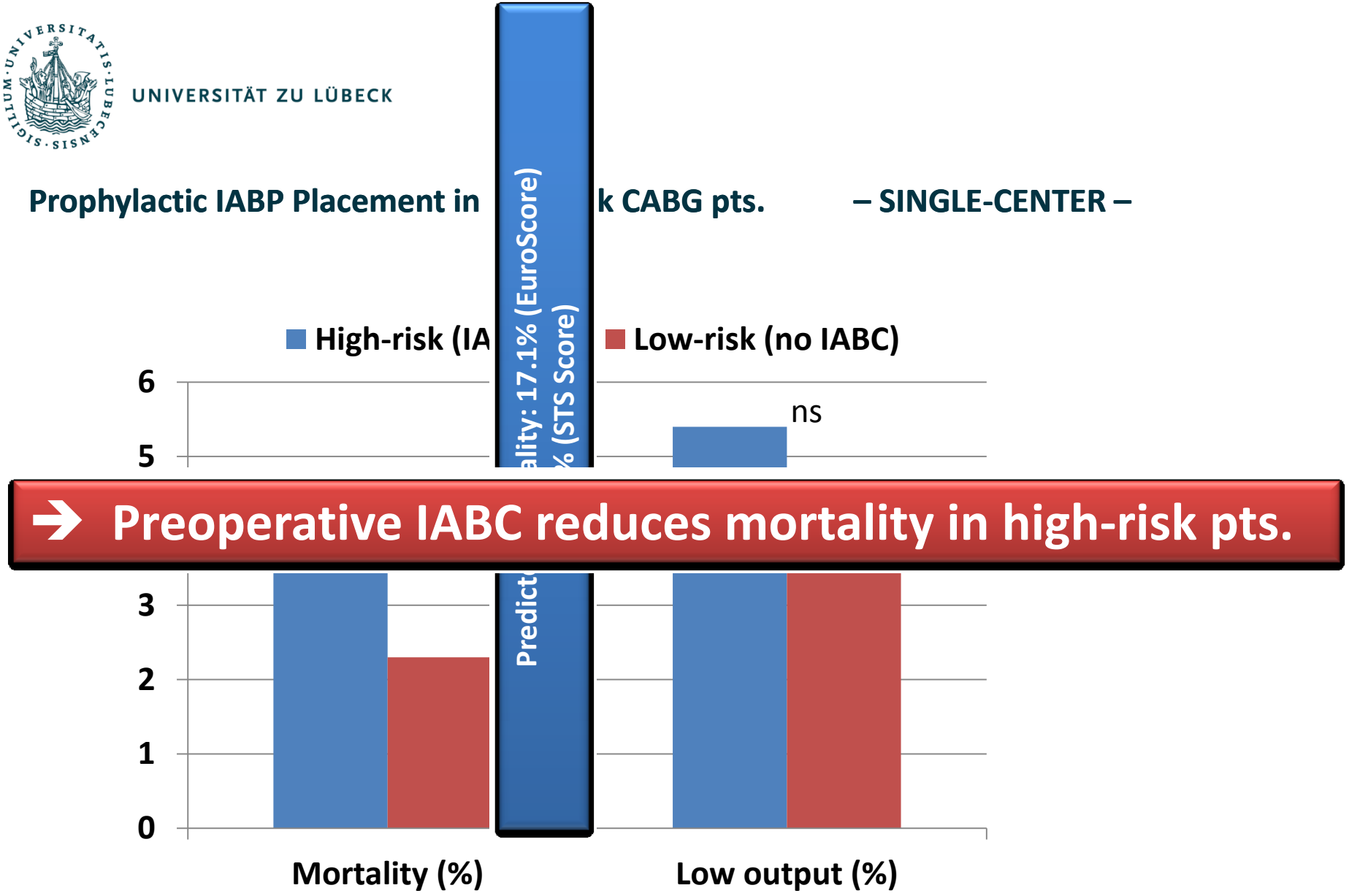
Prophylactic IABP Placement in k CABG pts. – SINGLE-CENTER –



→ **Preoperative IABC reduces mortality in high-risk pts.**

Santarpino et al. Ann Thorac Surg 2009;87:481-8

Prophylactic IABP Placement in high-risk CABG pts. – PROPENSITY-SCORE-ANALYSIS –

- **6121 high-risk CABG pts.** (EuroScore ≥ 8)
  - 1207 (19.7%) pre-OP IABC placement (left main >75%, unstable angina, EF <35%, recent MI, heart failure)
  - 4914 (80.3%) no IABC

- **478 pts in propensity-score analysis in IABC and no IABC group**

Lorusso et al. EJCTS 2010;38:585-91

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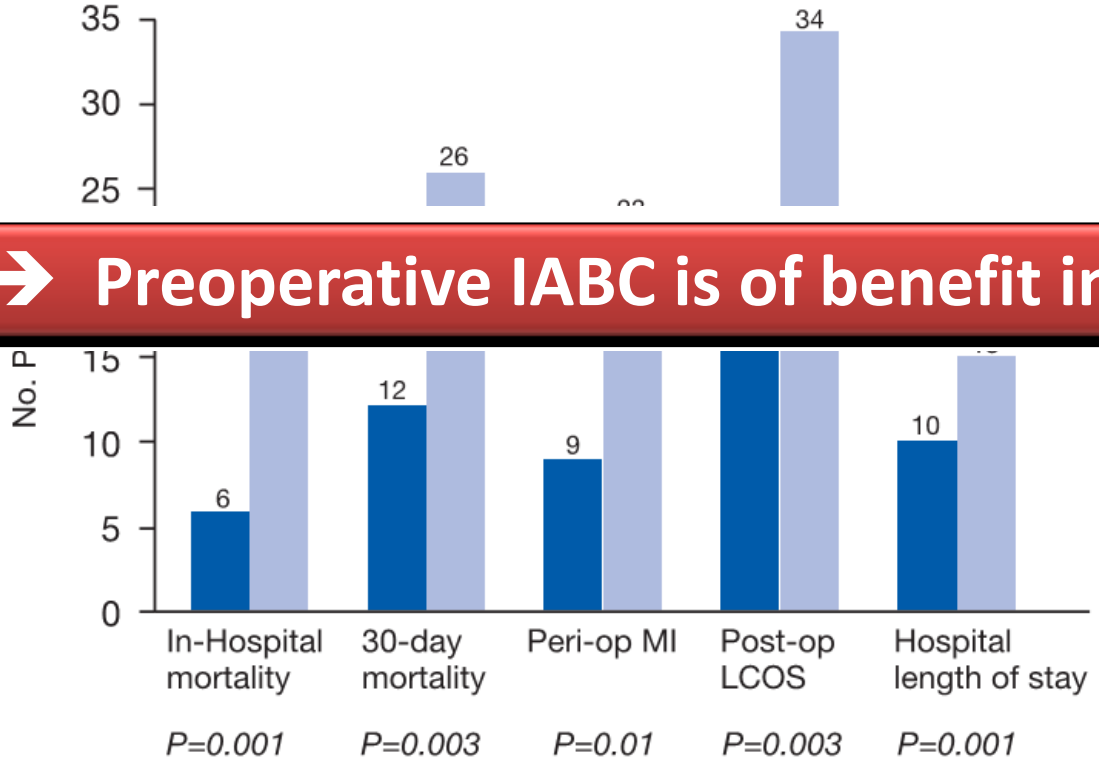
Prophylactic IABP Placement in high-risk CABG pts. – PROPENSITY-SCORE-ANALYSIS –



→ **Preoperative IABC is of benefit in high-risk CABG pts.**

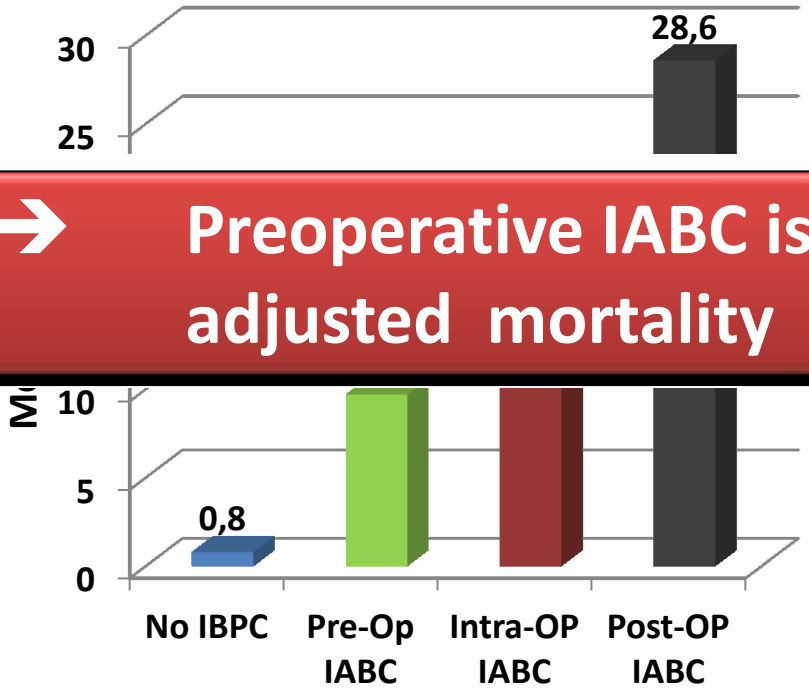
Lorusso et al. EJCTS 2010;38:585-91

IABP Placement in high-risk pts. – TIMING –

- **7440 consecutive pts.**
  - 218 (2.9%) **pre-OP** IABP placement
  - 184(2.5%) **intra-OP** IABP placement
  - 42 (0.6%) **post-OP** IABP placement
  - 6997 (94%) **no** IABP

Lavana et al. J Thorac Cardiovasc Surg 2010;140:80-5

IABP Placement in high-risk pts. – TIMING –



Multivariate adjusting for EuroSCORE

→ **Preoperative IABC is associated with low risk-adjusted mortality**

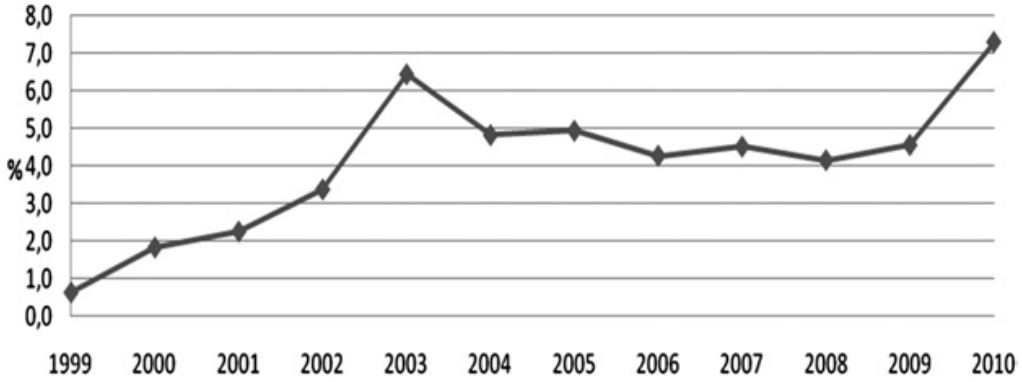
Model properties	
Hosmer-Lemeshow goodness-of-fit	$P = .01$

Lavana et al. J Thorac Cardiovasc Surg 2010;140:80-5

IABC Placement

– COMPLICATIONS –

- **423 CABG pts. receiving IABC pre or intra-OP**
  - EF < 35%
  - Left main stenosis
  - unstable hemodynamics
  - failure to wean from CBP

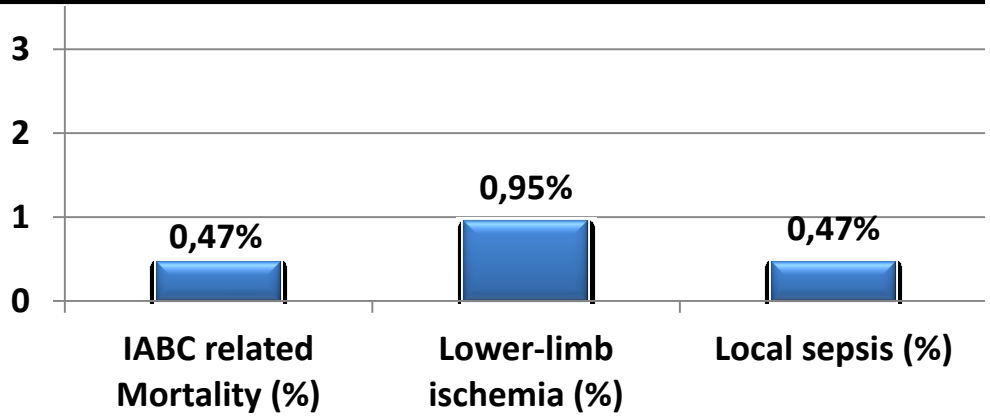


Severi et al. J Cardiothorac Vasc Anesthesia 2012; in print

IABC Placement – COMPLICATIONS –

- **IABC Insertion**
  - 99.29% percutanous femoral punction (sheat-less)
  - 0.47% femoral cut down
  - 0.24% ascending aorta

➔ **Elective preoperative IABC ha**
complication rate compared t



Severi et al. J Cardiothorac Vasc Anesthesia 2012; in print

Summary

- Increase in CO and perfusion
- Decrease in afterload and cardiac work
- Class IIa (LOE B) in high-risk CABG pts. (ACCF/AHA Guidelines 2011)
- Definition of high-risk pts?
- Newer studies (EuroScore) confirmed the positive effect of prophylactic IABC
- Low risk of complications in elective placement

Conclusion

In hemodynamically stable high-risk CABG pts. prophylactic IABP insertion is safe and effective in reducing postcardiotomy syndrome, perioperative myocardial infarction, length of stay and mortality.

Remaining questions….

- Clear definition of high-risk CABG pts.
- Ideal timing preoperatively

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Thank You!

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