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TAVR y Enfermedad Coronaria

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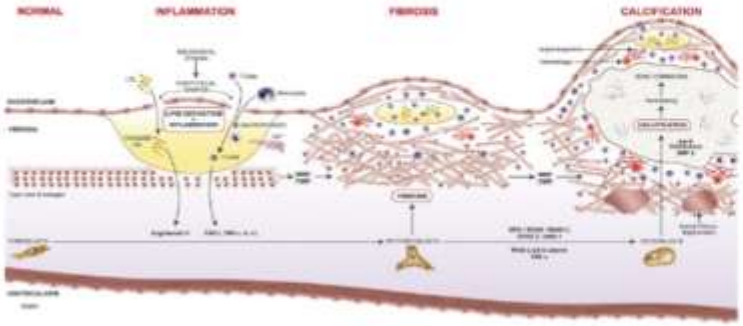
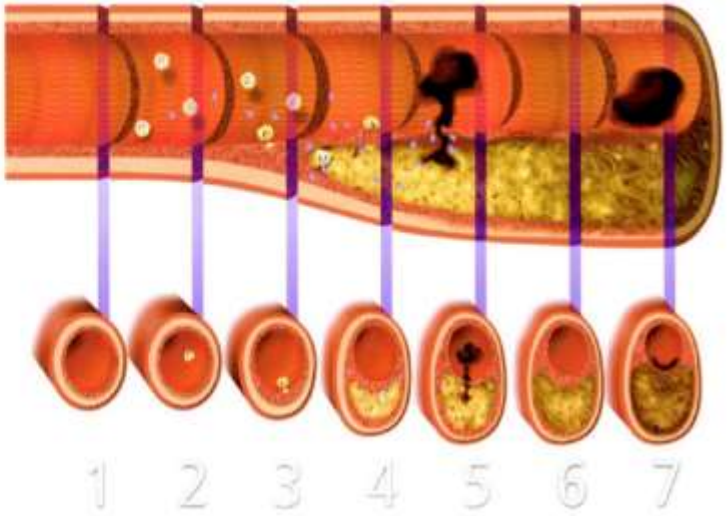
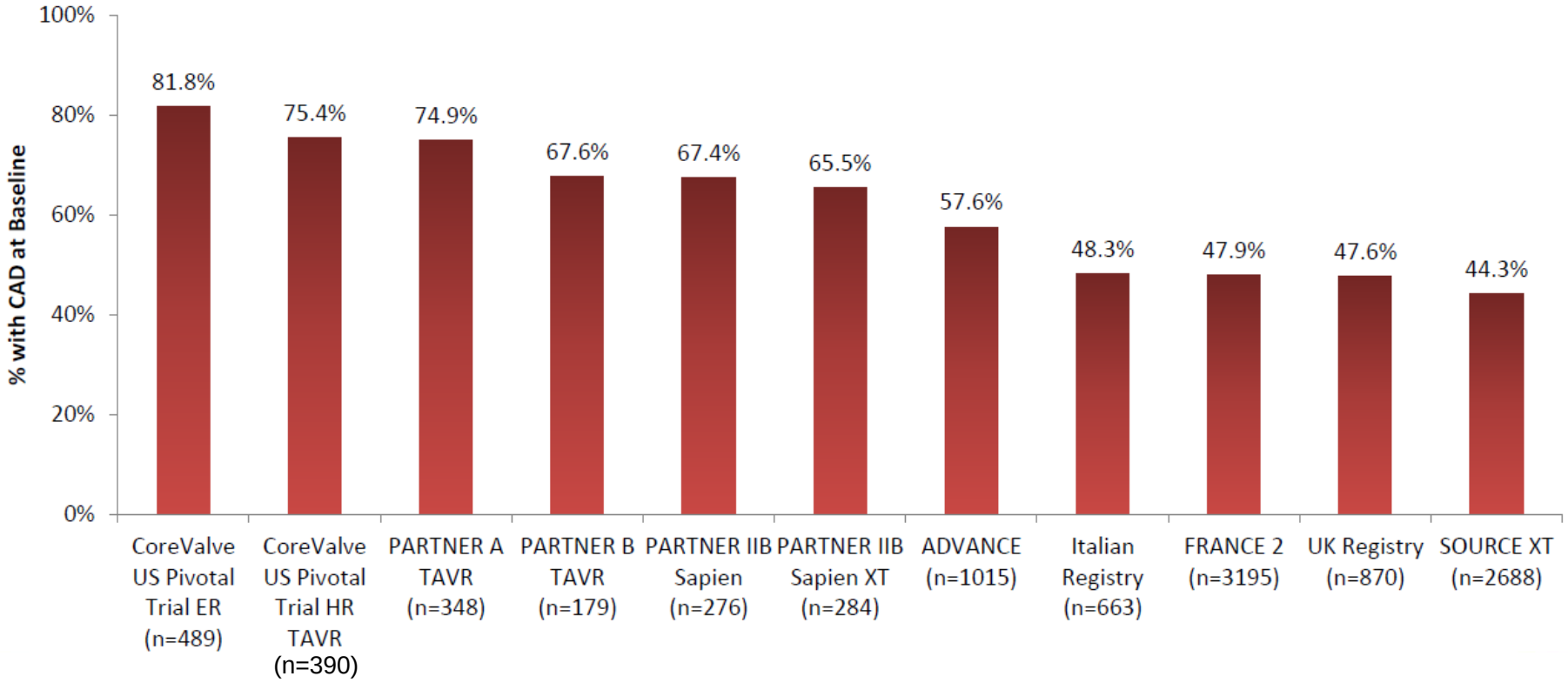
CAD and AS – Similar Pathological Processes





	Aortic Stenosis	Atherosclerosis
Initiating event	Increased mechanical stress and reduced shear stress causing endothelial damage	Increased mechanical stress and reduced shear stress causing endothelial damage
Predominant cell types	Macrophages and T helper cells Valve interstitial cells Myofibroblasts Osteoblasts	Macrophages and T helper cells Foam cells Vascular smooth muscle cells
Early pathology	Oxidized lipid deposition, inflammation	Oxidized lipid deposition, inflammation, foam cells
Later pathology	Calcification and fibrosis predominate Neovascularization and hemorrhage	Lipid deposition and pools, inflammation, and calcification Neovascularization and hemorrhage
Disease progression	Fibrosis, calcification, and hemorrhage	Lipid deposition and pools, inflammation, plaque rupture, and thrombosis
Mechanism of adverse events	Progressive valve rigidity due to calcification and fibrosis Decompensation of the hypertrophic response	Plaque rupture due to lipid-rich pool, inflammatory infiltrate, and thin fibrous cap Intravascular thrombosis

CAD in TAVR Patients

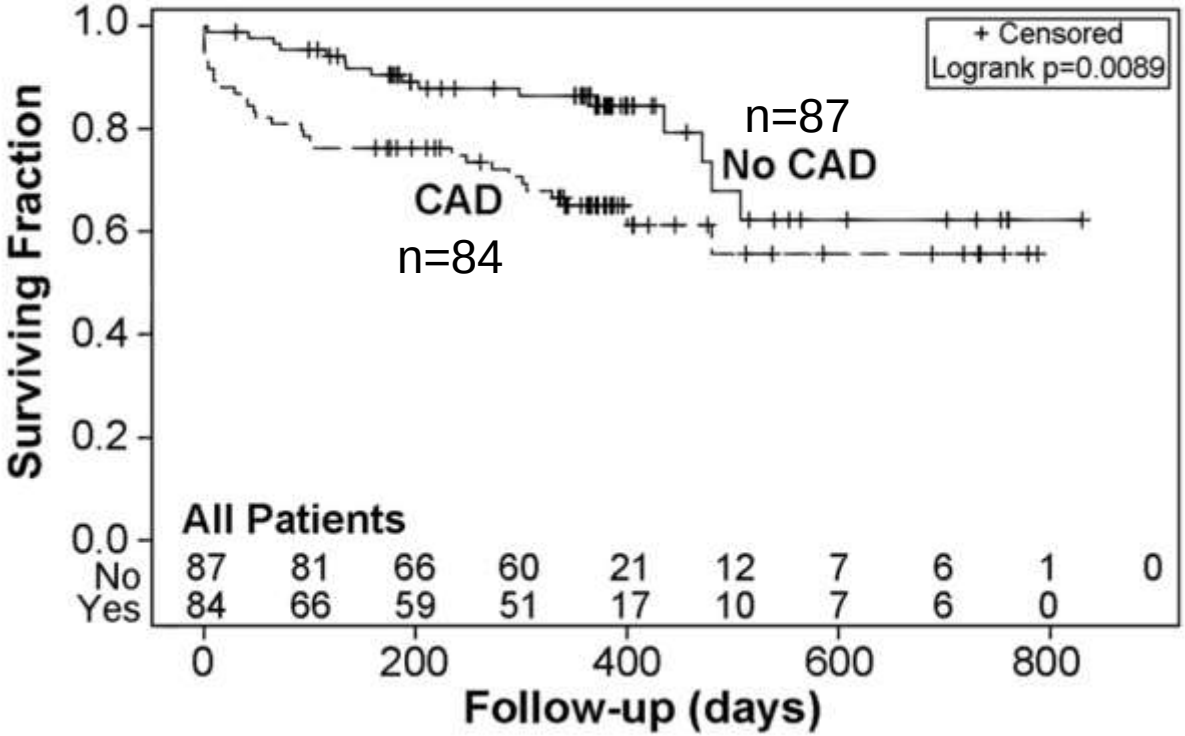


CAD and TAVR

- **Should we intervene before?**
  - Does CAD impact outcomes of TAVR?
  - How safe is it to perform PCI in patients with AS?
  - What stents and how long interval between PCI and TAVR?
  - How to manage DAP?
- **Should we intervene after?**
  - Only if patients symptomatic after AVR?
  - Technical challenges
- **Never or Simultaneous**

Survival of Patients after TAVR

N= 171, TF = 136, TA = 35



Dewey et al, Ann Thorac Surg 2010;89:758–67

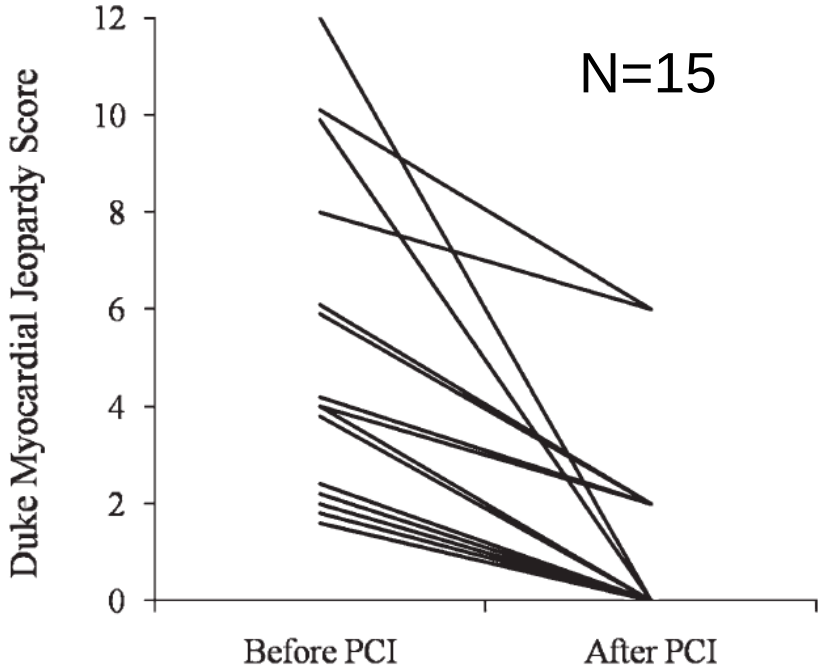
CAD + TAVR

	Findings
Dewey (N=171)	CAD ↑ 30 day mortality OR 10.1 Overall mortality OR 20.3
Massen (N=136)	CAD no increased 30 day or 1 year mortality
Gautler (N=145)	CAD no increased 30 day or 1 year mortality
Wenaweser (N=256)	CAD no increased 30 day mortality with TAVR alone vs PCI + TAVR
Khawaja (N=164)	CAD ↑ 30 day and 12 month mortality OR 2.92
USSIA (N=659)	CAD no increased 1 year mortality
Wender (N=2,307)	CAD no increased risk with and without prior CABG

Goel SS et al, J Am Coll Cardiol 62:1-10, 2013

CAD and TAVR

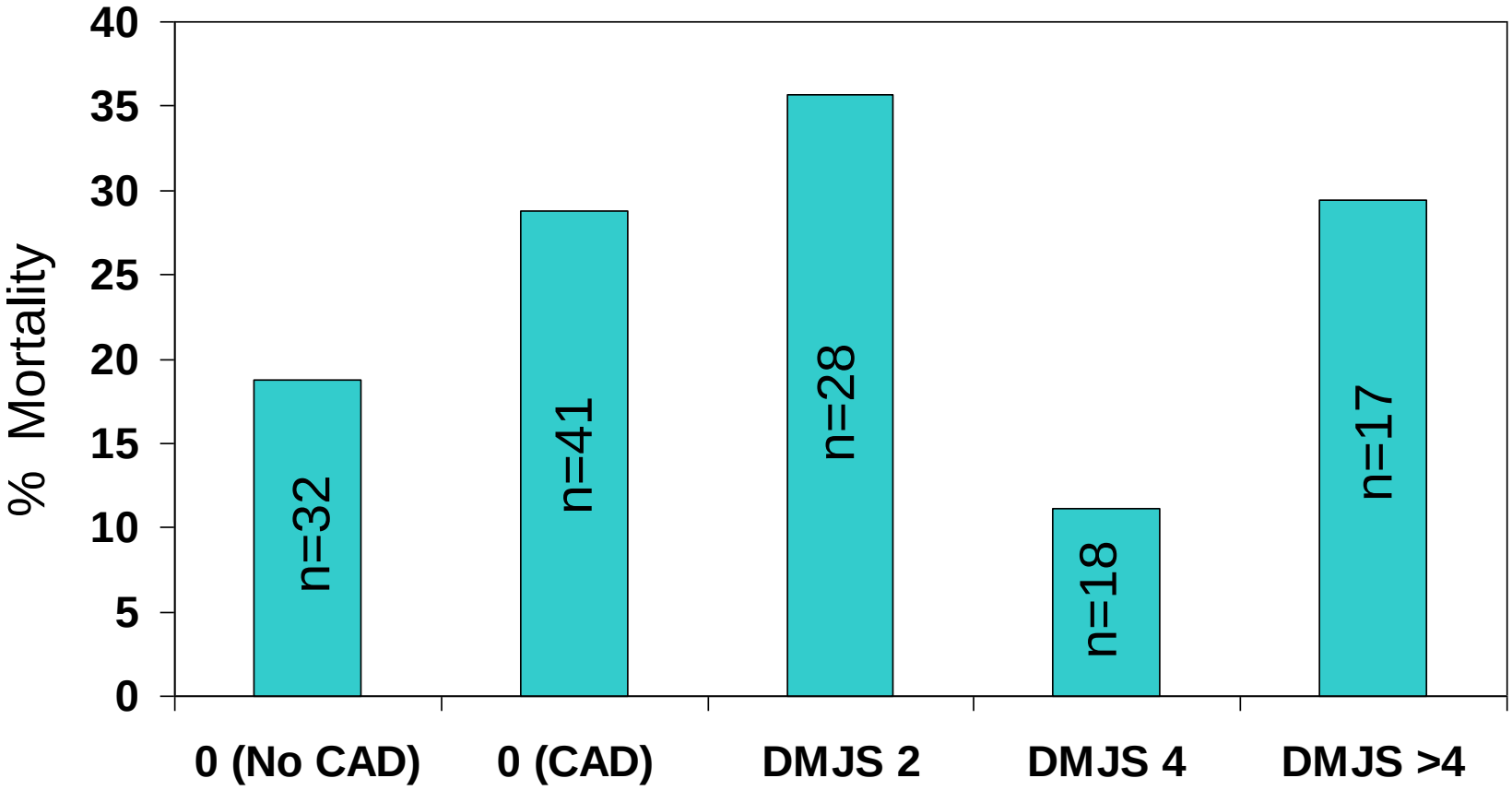
Overall population	Group A	Group B	Group C	Group D	Group E
	(DMJS 0, no CAD)	(DMJS 0, CAD)	(DMJS 2)	(DMJS 4)	(DMJS 6-12)
$n = 136$	$n = 32$	$n = 41$	$n = 28$	$n = 18$	$n = 17$



- DMJS (Duke Myocardial Jeopardy Score) was used to "quantify" myocardium at risk
- TF=93, TA=46
- N=73 (54%) with DMNJ = 0

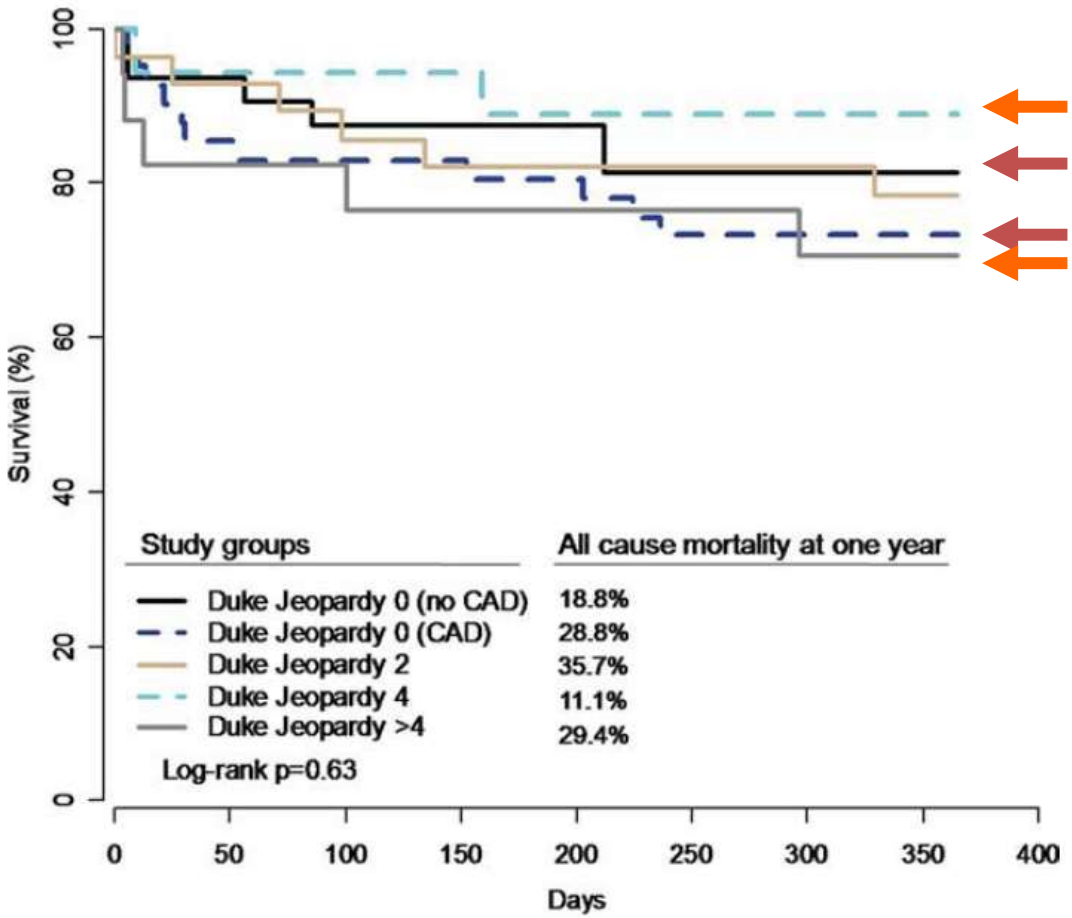
Masson J-B et al, Cath and Cardio Int, 76:165–173 (2010)

CAD and TAVR: 1 Year Mortality



Masson J-B et al, Cath and Cardio Intervention, 76:165–173 (2010)

CAD and TAVR: Survival Curves



Masson J-B et al, Cath and Cardio Intervention, 76:165–173 (2010)

Aortic Stenosis and CAD

- Non-randomized single-center experience
- 243 high-risk patients with AS and CAD
  - STS score >10%
  - EuroScore >15%
- Group 1: SAVR + CABG (N=184)
- Group 2: PCI then TAVR within 12 months (N=59)
- Propensity score to assess 30-day mortality

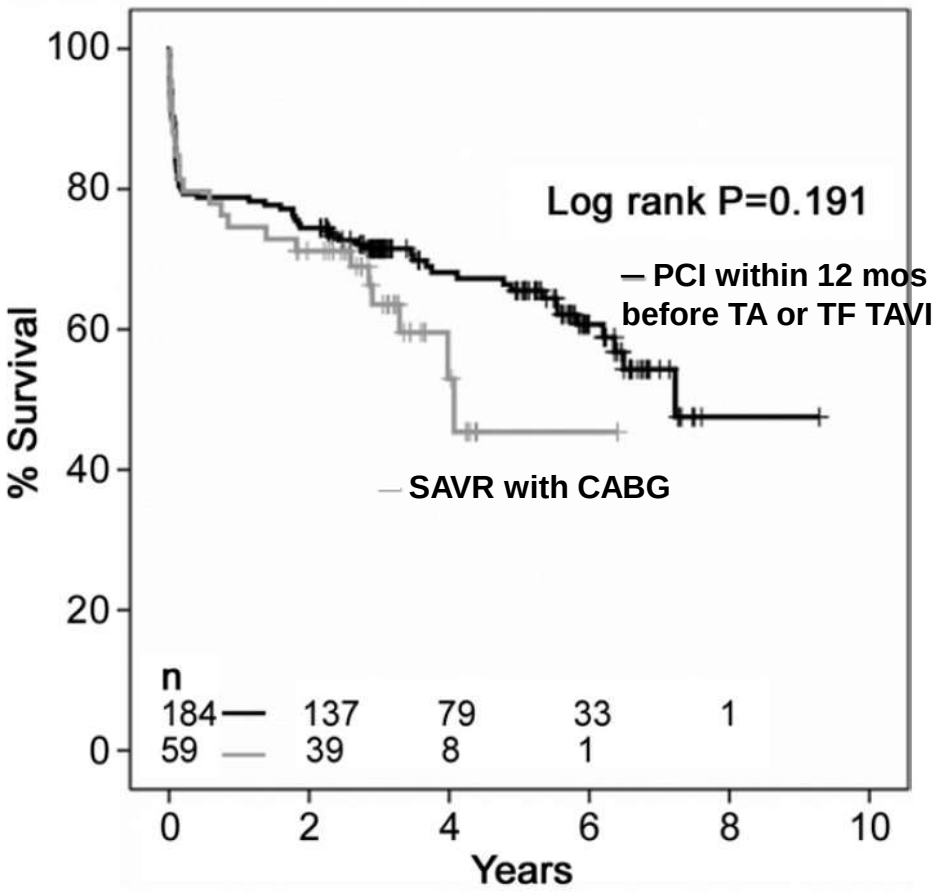
Wendt D et al: Ann Thorac Surg , 95:599-605, 2013

Aortic Stenosis and CAD

- Group 2:
  - Older 80 vs 75 years
  - More PVD 42.4% vs 27.1%
  - More 1 VD 55.9% vs 34.8%
  - Higher STS score 16.7 vs 13.1
- BMS – 69.5%
- DES – 30.5%

Wendt D et al: Ann Thorac Surg , 95:599-605, 2013

Kaplan-Meier Survival Curves



Wendt D et al: Ann Thorac Surg , 95:599-605, 2013

Management of High-Risk Patients With Aortic Stenosis and Coronary Artery Disease

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femoral transcatheter aortic valve implantation (group 2, n = 59). A propensity score adjusted regression analysis was used to compare 30-day mortality as the primary study endpoint between the groups.

Results. Group 1 mean age (75 ± 6 years), EuroSCORE (18.1% ± 13.8%), and STS score (13.1% ± 8.7%) were significantly different from group 2 (mean age 80 ± 6 years, EuroSCORE 27.5% ± 16.3%, and STS score 16.7% ± 10.5%; $p <$

Conclusions. The present study demonstrates that transcatheter aortic valve implantation in combination with prior percutaneous coronary intervention within 12 months produces similar results in a propensity score matched high-risk patient population.

(Ann Thorac Surg 2013;95:599–605)

Conclusions: The present study demonstrates that transcatheter aortic valve implantation in combination with prior percutaneous coronary intervention within 12 months produces similar results in a propensity score matched high-risk patient population.

Surgical aortic valve replacement (AVR) and coronary artery bypass grafting (CABG) is currently the proven standard therapy for patients with aortic stenosis and concomitant coronary artery disease [1, 2]. It is anticipated that coronary artery disease preexists in approximately 25% of patients presenting with aortic valve stenosis and may increase as much as 50% in the prevalence of typical angina [3]. However, coexisting coronary artery disease clearly increases operative morbidity and mortality in such concomitant operations [4].

Transcatheter aortic valve implantation (TAVI), as an alternative to conventional aortic valve replacement, has currently changed the paradigms in the treatment of aortic valve stenosis (5). This technique has been initially considered as a stand-alone procedure only targeting patients presenting with ized controlled trial suggested TAVI to be as good as surgery [8]. However, in daily practice, more and more patients are presenting with coronary artery disease, which is often treated in the forefront or even during transcatheter aortic valve implantation. This group of patients should, therefore, be compared with patients who undergo concomitant aortic valve replacement with CABG surgery rather than with patients who have isolated aortic valve replacement.

The aim of the present study was to compare the outcome of patients treated completely percutaneously (TAVI plus percutaneous coronary intervention [PCI]) with the outcome of patients who underwent a complete surgical concomitant operation (AVR plus CABG).

Complete Revascularization Is Not a Prerequisite for Success in Current Transcatheter Aortic Valve Implantation Practice

Nicolas M. Van Mieghem, MD,* Robert M. van der Boon, MSc,* Elhamula Faqiri, MSc,*
Roberto Diletti, MD,* Carl Schultz, MD, PhD,* Robert-Jan van Geuns, MD, PhD,*
Patrick W. Serruys, MD, PhD,* Arie-Pieter Kappetein, MD, PhD,†
Ron T. van Domburg, PhD,* Peter P. de Jaegere, MD, PhD*

Rotterdam, the Netherlands

Objectives This study sought to assess in patients undergoing transcatheter aortic valve implantation (TAVI), the prevalence and impact of incomplete coronary revascularization defined as >50% coronary artery or graft diameter stenosis on visual assessment of the coronary angiogram.

Background TAVI is an established treatment option in elderly patients with aortic stenosis (AS) and a (very) high operative risk. Coronary artery disease (CAD) is often associated with AS.

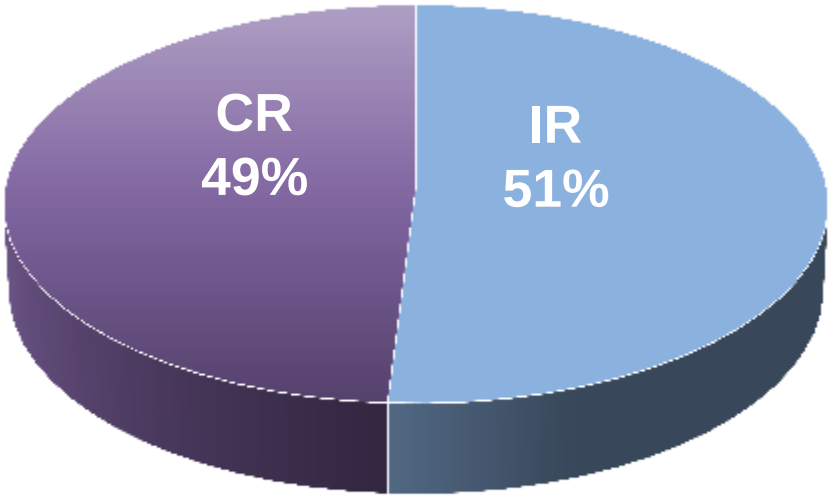
Methods A single-center cohort of consecutive patients undergoing TAVI between November 2005 and June 2012 was evaluated for the presence of significant CAD. The decision to revascularize and pursue complete revascularization was made by heart team consensus.

Results A total of 263 consecutive patients with a mean age of 80 ± 7 years and 51% male underwent TAVI with a median follow-up duration of 16 months (interquartile range: 4.2 to 28.1 months). Significant CAD with myocardium at risk was present in 124 patients (47%), 44 of whom had had previous coronary artery bypass grafting (CABG), and the median SYNTAX score in the 81 patients without previous CABG was 9.00 (2.38 to 15.63). Staged percutaneous coronary intervention (PCI) was planned in 19 (15%) and concomitant PCI with TAVI in 20 (16%). The median post-procedural residual SYNTAX score of patients without prior CABG was 5.00 (0.13 to 9.88). Overall, 99 patients (37%) (61 with no CABG and 38 CABG patients) had incomplete revascularization after TAVI. Revascularization status did not affect clinical endpoints. Kaplan-Meier survival curves for patients with and without complete revascularization demonstrated a 1-year mortality of 79.9% versus 77.4% ($p = 0.85$), respectively.

Conclusions In an elderly patient population undergoing TAVI for severe AS, a judicious revascularization strategy selection by a dedicated heart team can generate favorable mid-term outcome obviating the need for complete coronary revascularization. (J Am Coll Cardiol Intv 2013;6:867–75) © 2013 by the American College of Cardiology Foundation

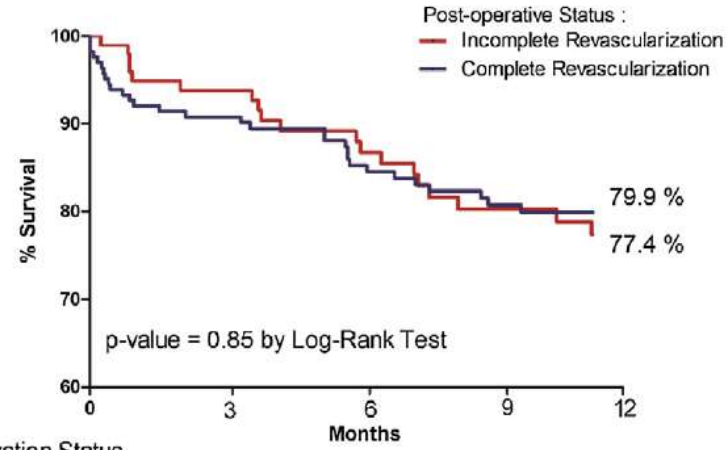
Role of Complete Revascularization

- Single center experience of TAVR
- 263 consecutive patients
  - 47% (124) had CAD
- PCI undertaken in 39 patients
  - Staged in 19
  - Concomitant in 20
- Assessed CR on outcome

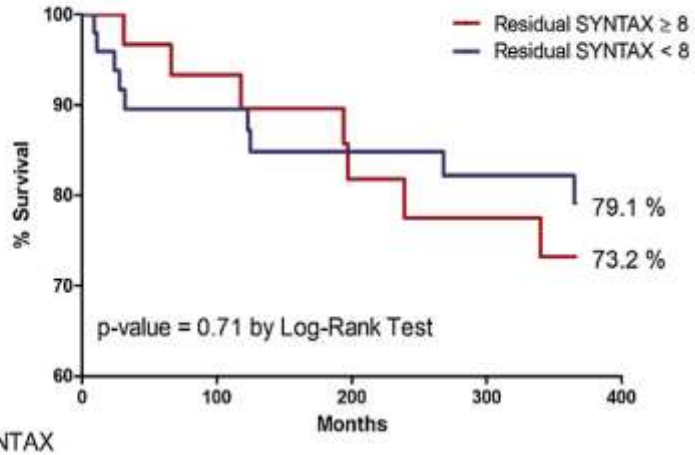


Van Mieghem NM et al: J Am Coll Cardiol Intv 6:867-75, 2013

Kaplan-Meier Survival Curves



No. at Risk Revascularization Status					
Complete	164	141	125	106	93
Incomplete	99	83	73	60	54



No. at Risk Residual SYNTAX					
SYNTAX ≥ 8	30	25	23	18	17
SYNTAX < 8	50	40	33	31	26

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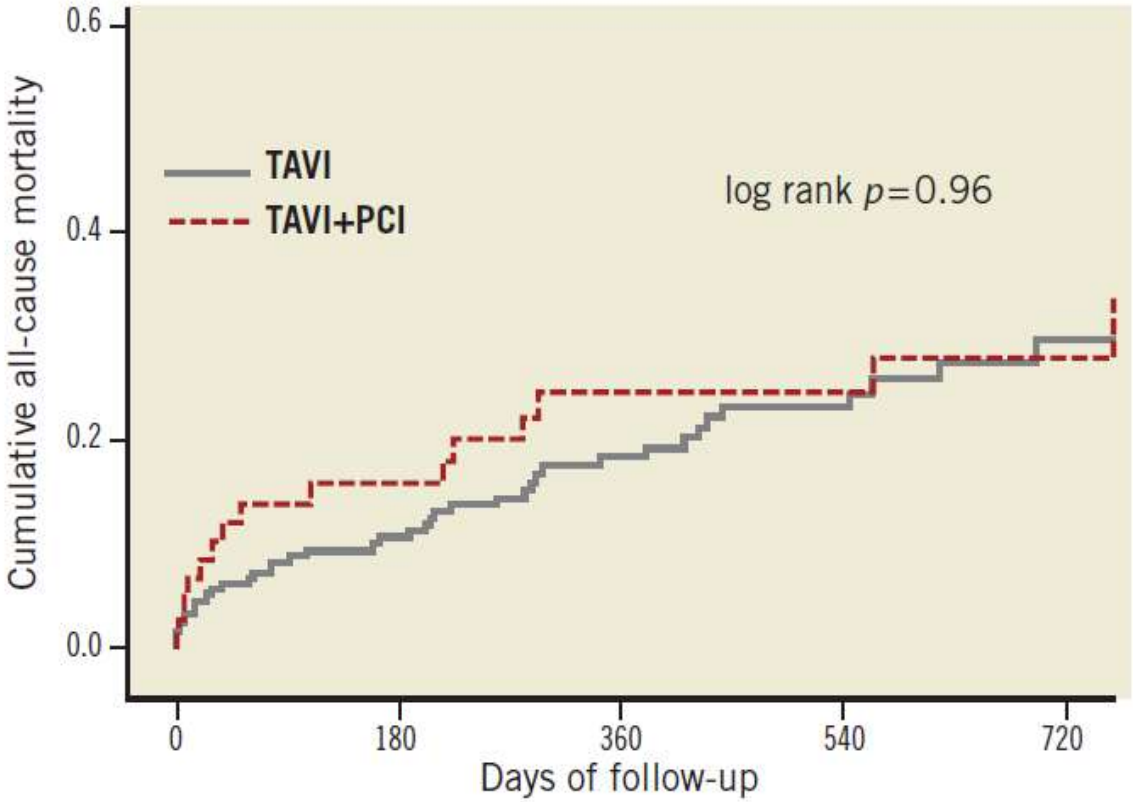
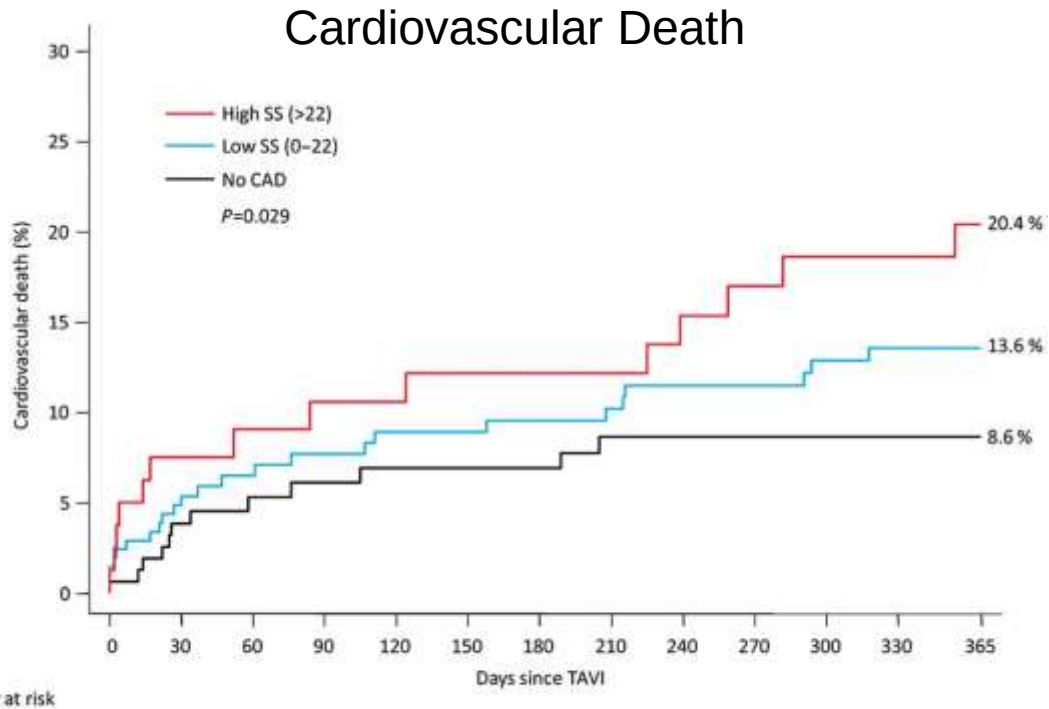
Bern Experience



TAVI	197	145	89	62	30
TAVI+PCI	59	41	31	25	12

EuroIntervention 2011;7:541-548

CAD Severity and Outcomes after TAVR



Number at risk													
High SS (>22)	80	73	59	57	57	55	55	55	53	51	49	48	45
Low SS (0–22)	207	192	157	152	149	149	143	137	133	132	128	125	123
No CAD	158	149	123	117	115	115	111	104	102	102	101	100	96

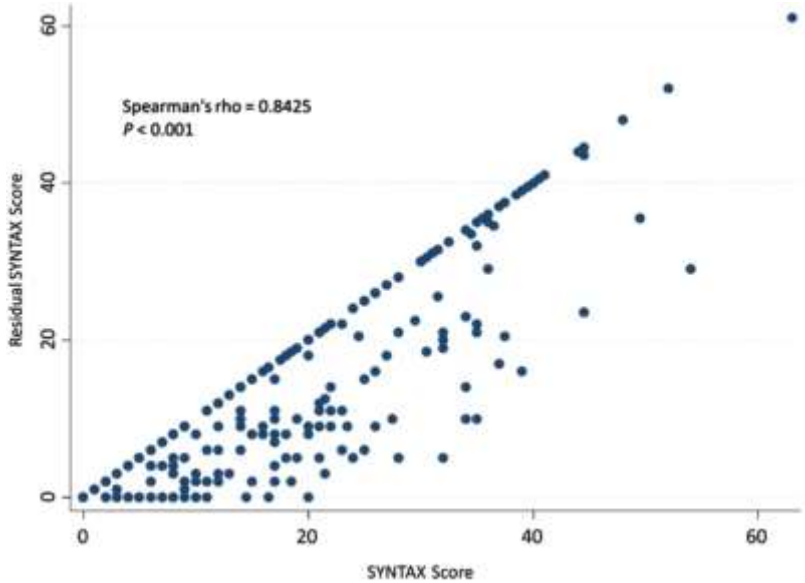
N=445, Mean Age 82.5±5.8
Baseline CAD Syntax Score 16.5±12.5

Stefanini GG et al. EHJ 2014;35:2530–2540

CAD Severity and Outcomes after TAVR

48.4% underwent PCI before TVR

SS >22 associated with increased risk of the primary endpoint without reaching statistical significance (HR: 1.68, 95% CI: 0.94–3.02, *P* = 0.079).



Correlation between the baseline and residual SYNTAX-score

	Overall (*n* = 445)	No CAD (*n* = 158)	Residual SYNTAX-score		Low (0–14) vs. No CAD		High (>14) vs. No CAD		Overall *P*-value
			Low (0–14) (*n* = 192)	High (>14) (*n* = 95)	RR (95% CI)	*P*-value	RR (95% CI)	*P*-value	
Events at 1 year									
Cardiovascular death, stroke, or MI	67 (17.3)	18 (12.5)	28 (16.5)	21 (26.3)	1.30 (0.72–2.34)	0.39	1.92 (1.02–3.61)	0.042	0.043
All-cause death, stroke, or MI	89 (23.0)	27 (19.4)	38 (22.4)	24 (29.6)	1.18 (0.72–1.93)	0.52	1.47 (0.85–2.55)	0.17	0.18
All-cause death	76 (19.9)	23 (16.9)	34 (20.3)	19 (23.6)	1.26 (0.74–2.14)	0.39	1.36 (0.74–2.49)	0.33	0.31
Cardiovascular death	50 (13.1)	12 (8.6)	24 (14.3)	14 (17.7)	1.70 (0.85–3.40)	0.13	1.91 (0.89–4.14)	0.10	0.09

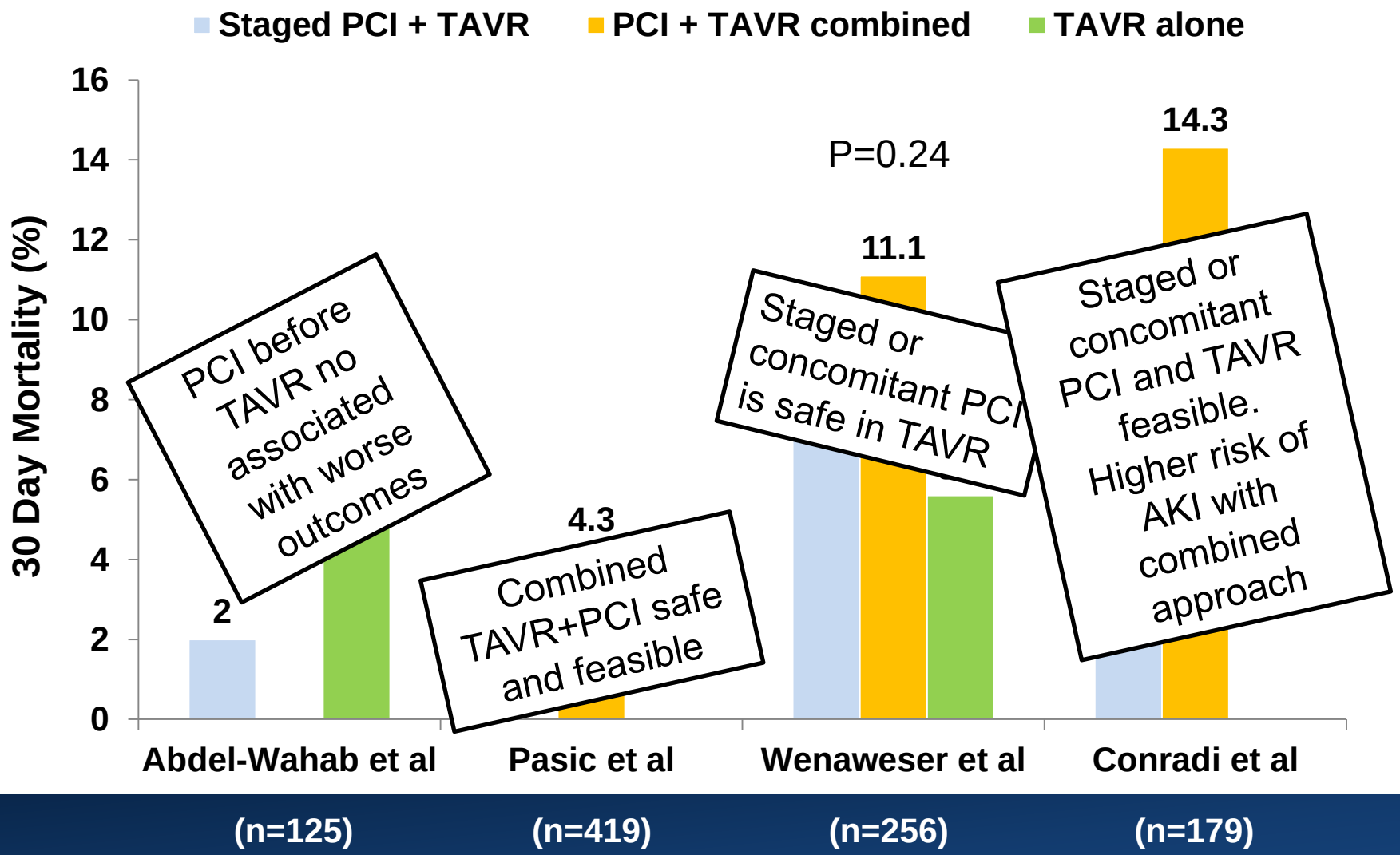
Stefanini GG et al. EHJ 2014;35:2530–2540

Timing of PCI and TAVI

PCI Prior to TAVI		PCI Combined with TAVI		PCI After TAVI	
Pro	Con	Pro	Con	Pro	Con
Simplified coronary access with no prosthetic valve in place	DAPT required after PCI may impact post-TAVI bleeding	Decreases the risk of mortality while waiting for TAVR	Increased dye load (contrast nephropathy), longer procedure time	Treating severe AS first may improve myocardial perfusion, decreasing need for PCI	Potential access issues, valve struts interfering with coronary cannulation
Less risk of hemodynamic instability and ischemia during TAVI	Risks of performing PCI in the presence of severe AS	Reduction of vascular complications by needing one access site			Catheter manipulation could move the valve
Minimize contrast load by giving it at 2 separate times		Less risk of hemodynamic instability and ischemia during TAVI			Higher risk of hemodynamic instability and ischemia during TAVI

Goel SS et al, J Am Coll Cardiol 62:1-10, 2013

Staged or Combined PCI with TAVR



Goel SS et al, J Am Coll Cardiol 62:1-10, 2013

STATE-OF-THE-ART PAPERS Goel SS et al, J Am Coll Cardiol 62:1-10, 2013

Severe Aortic Stenosis and Coronary Artery Disease—Implications for Management in the Transcatheter Aortic Valve Replacement Era

A Comprehensive Review

Sachin S. Goel, MD,* Mobolaji Ige, MD,† E. Murat Tuzcu, MD,* Stephen G. Ellis, MD,* William J. Stewart, MD,* Lars G. Svensson, MD, PHD,‡ Bruce W. Lytle, MD,‡ Samir R. Kapadia, MD*

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Significant CAD is present in 40% to 75% of patients undergoing TAVR. The impact of CAD on outcomes after TAVR remains understudied. Based on existing data, not all patients require revascularization before TAVR. Percutaneous coronary intervention (PCI) should be considered for severely stenotic lesions in proximal coronaries that subtend a large area of myocardium at risk. Ongoing studies randomizing patients to surgical or percutaneous management strategies for severe AS will help provide valuable data regarding the impact of CAD on TAR outcomes, the role of PCI and its timing in relation to TAVR.

severe AS (2–5). Surgical aortic valve replacement (SAVR) and concomitant coronary artery bypass grafting (CABG) has been the standard management strategy for patients with severe symptomatic AS and CAD (6). Recently, transcatheter aortic valve replacement (TAVR) has emerged as a less invasive and feasible treatment option in patients at high risk for conventional SAVR (7,8). More than 50,000 TAVRs have been performed around the world to date; however, there is no consensus on the management of severe CAD in this setting. We reviewed the available published data to understand: 1) the prevalence of CAD in patients with severe AS; 2) clinical impact of CAD on the outcomes of TAVR; and 3) the management options for CAD in patients with severe AS undergoing TAVR.

patients required concomitant CABG, whereas in patients over the age of 80 years, >65% had concomitant CABG (9,10). Several surgical databases have shown that CABG increases operative and short-term mortality with SAVR (11–14). Similarly, concomitant CABG appears to have an adverse effect on long-term outcomes after SAVR (9,15). However, there are no randomized controlled trials of CABG+SAVR compared with SAVR alone in the presence of significant CAD. It is possible that the increase in short- and long-term mortality in patients undergoing concomitant CABG and SAVR compared with SAVR alone might be a reflection of more severe and diffuse atherosclerosis in the former group, which renders this population sicker and direct comparisons with those undergoing SAVR difficult to interpret (16). In a study comparing the outcomes of SAVR

Percutaneous Coronary Intervention in Patients With Severe Aortic Stenosis

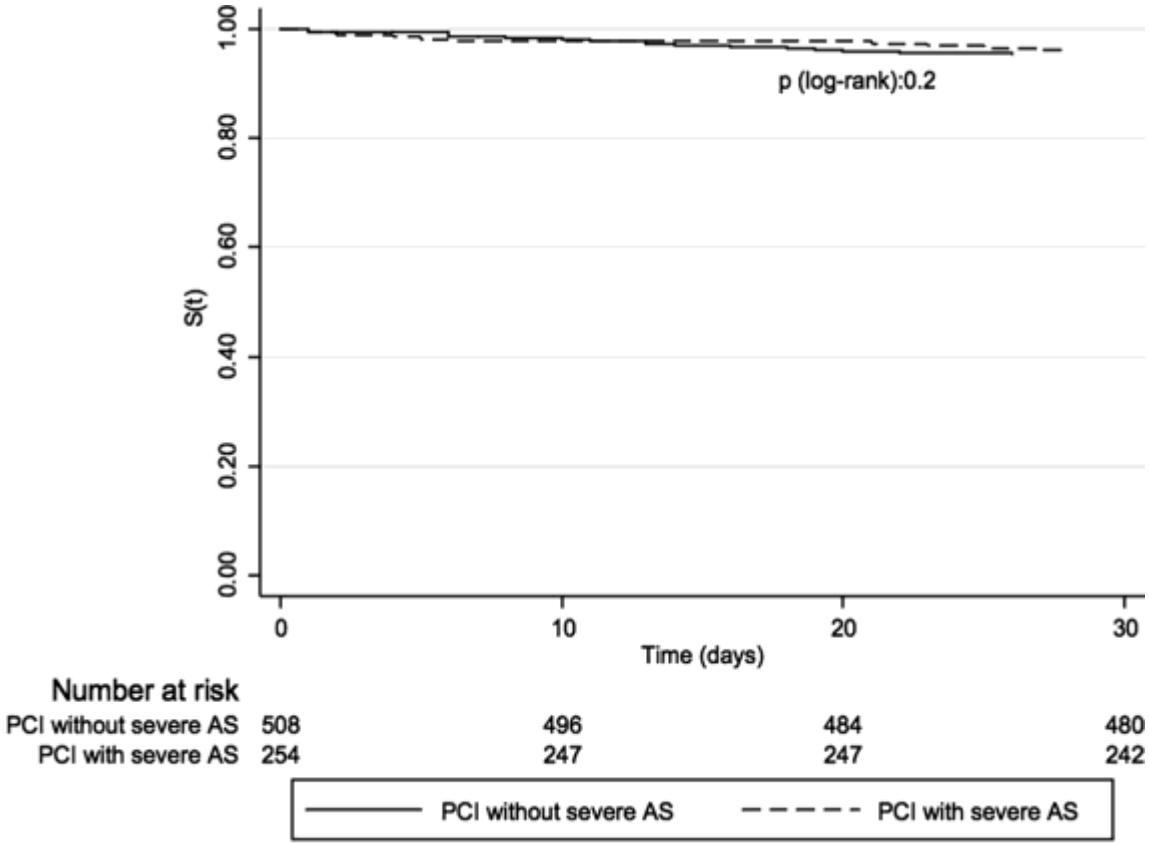
Implications for Transcatheter Aortic Valve Replacement

Sachin S. Goel, MD; Shikhar Agarwal, MD, MPH, CPH; E. Murat Tuzcu, MD; Stephen G. Ellis, MD; Lars G. Svensson, MD, PhD; Tarique Zaman, MD; Navkaranbir Bajaj, MD; Lee Joseph, MD; Neil S. Patel, BS; Olcay Aksoy, MD; William J. Stewart, MD; Brian P. Griffin, MD; Samir R. Kapadia, MD

- Cases
  - 254 patients with severe AS who underwent PCI between Jan 1998 and Dec 2008 for any indication
  - Severe AS
    - AVA <1.0 cm2
    - Mean gradient > 40 mm Hg
    - Jet velocity > 4.0 m/s.
- Controls
  - 508 patients without AS who underwent PCI, propensity matching (1:2).
- Primary end point: 30-day mortality after PCI.
- Secondary end points: procedural complications including contrast nephropathy, peri-procedural MI, procedural death, hemodynamic compromise during PCI

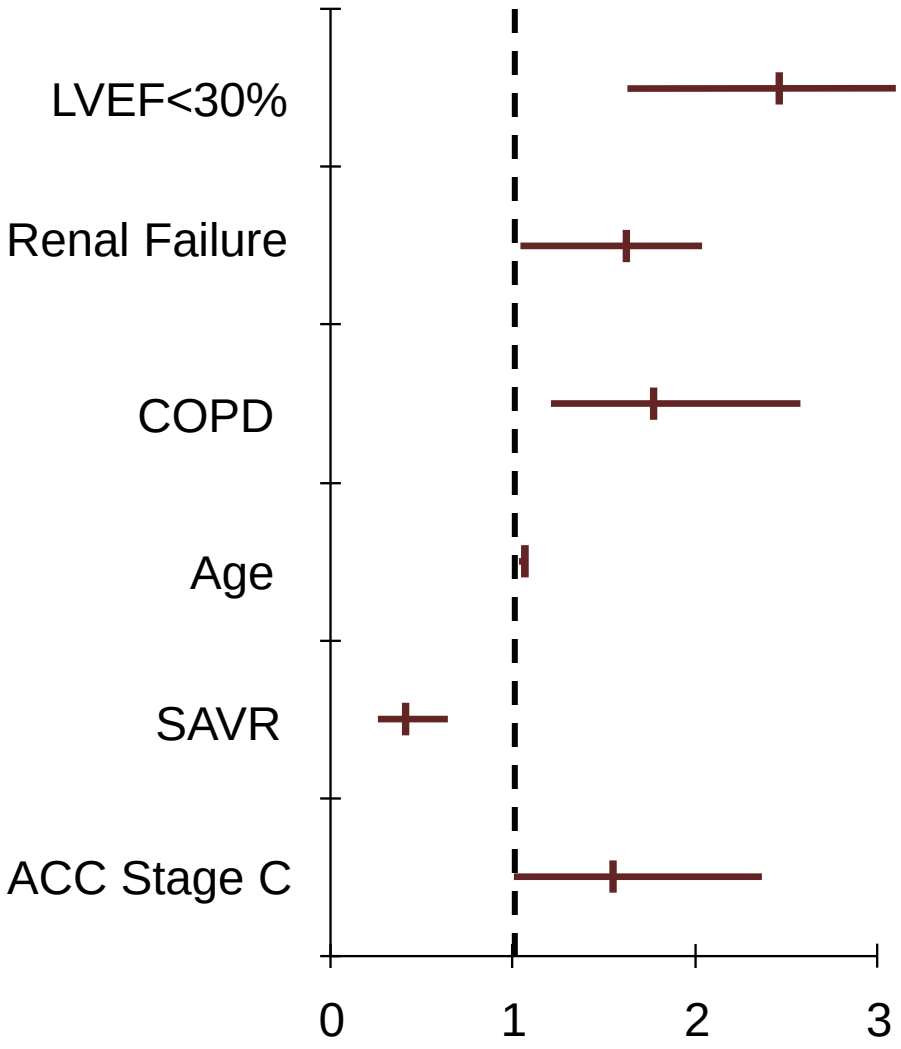
Goel et al. *Circulation*. 2012;125:1005-1013

30 day Survival



Goel et al. *Circulation*. 2012;125:1005-1013

PCI in Severe AS: Predictors of 1 year Survival



PCI can be performed in patients with severe symptomatic AS and CAD without an increased risk of short-term mortality compared with propensity-matched patients without AS.

Patients with ejection fraction 30% and STS score 10% are at a highest risk of 30-day mortality after PCI.

Goel et al. *Circulation*. 2012;125:1005-1013

Consideration for Stents

- DES versus BMS
  - BMS in patients with AF, large focal lesions
  - DES in most other patients
- Stenting of LMT or ostial RCA
  - Precise placement of stent in ostium
  - ? Protection of stent during procedure
- Duration between PCI and TAVR
  - Currently 1 month for BMS and 6 month for DES (?)

DAPT and TAVR

- No consensus for TA-TAVR cases
- Risk for emergent conversion (small)
- Combination with anticoagulation in patients with AF

Individualized Management

- Can TAVR be performed safely in the setting of the patient's coronary anatomy?
- And will the extent of CAD impact the patient's symptoms as well as long-term survival?

Conclusions

- CAD is commonly encountered in AS patients
- Presence or absence of CAD and history of revascularization do not correlate with worse procedural outcome with TAVR
- Data on impact of CAD on long term outcome after TAVR remains understudied
- Patients should be treated with TAVR sooner rather than later after PCI
- PCI may be safely performed in patients with AS
- Choice of stents and DAPT regimen should be individualized