Non-cardiac surgery in severe valvular disease

David Leibowitz MD
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Recommendation on VHD

Recommendation	Class[a]	Level[b]
In the presence of severe VHD it is recommended that a clinical and echocardiographic evaluation be performed and, if needed, treatment before non-cardiac surgery	I	C

[a]Class of recommendation.
[b]Level of evidence.
VHD = valvular heart disease.

ESC Perioperative guidelines, 2009

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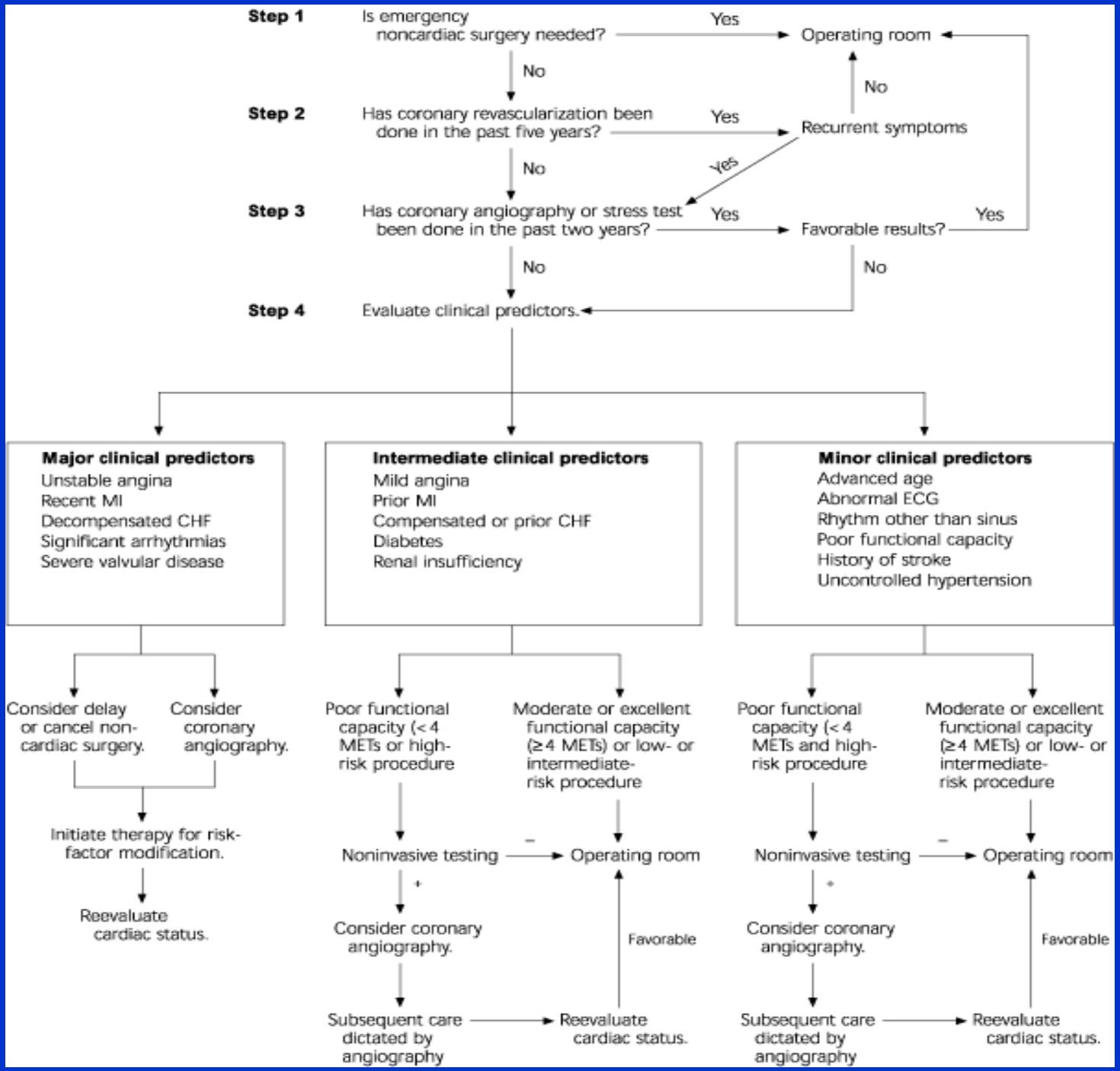

Step 1
Is emergency noncardiac surgery needed?
Yes
Operating room
No
No
Step 2
Has coronary revascularization been done in the past five years?
Yes
Recurrent symptoms
No
Yes
Step 3
Has coronary angiography or stress test been done in the past two years?
Yes
Favorable results?
Yes
No
No
Step 4
Evaluate clinical predictors.
Major clinical predictors
Unstable angina
Recent MI
Decompensated CHF
Significant arrhythmias
Severe valvular disease
Intermediate clinical predictors
Mild angina
Prior MI
Compensated or prior CHF
Diabetes
Renal insufficiency
Minor clinical predictors
Advanced age
Abnormal ECG
Rhythm other than sinus
Poor functional capacity
History of stroke
Uncontrolled hypertension
Consider delay or cancel non-cardiac surgery.
Consider coronary angiography.
Initiate therapy for risk-factor modification.
Reevaluate cardiac status.
Poor functional capacity (< 4 METs or high-risk procedure
Moderate or excellent functional capacity (≥ 4 METs) or low- or intermediate-risk procedure
Noninvasive testing
–
Operating room
+
Consider coronary angiography.
Favorable
Subsequent care dictated by angiography
Reevaluate cardiac status.
Poor functional capacity (< 4 METs and high-risk procedure
Moderate or excellent functional capacity (≥ 4 METs) or low- or intermediate-risk procedure
Noninvasive testing
–
Operating room
+
Consider coronary angiography.
Favorable
Subsequent care dictated by angiography
Reevaluate cardiac status.

What is the risk of severe AS?

- Up to 9% of patients > 65 years
- Reduced LV compliance
  - Preload dependence
  - Reliance on atrial “kick”
- Reduced coronary reserve
  - Susceptibility to ischemia due to hypotension
- Inability to raise cardiac output

Volume 297 OCTOBER 20, 1977 Number 16

MULTIFACTORIAL INDEX OF CARDIAC RISK IN NONCARDIAC SURGICAL PROCEDURES

LEE GOLDMAN, M.D., M.P.H., DEBRA L. CALDERA, R.N., SAMUEL R. NUSSBAUM, M.D., FREDERICK S. SOUTHWICK, M.D., DONALD KROGSTAD, M.D., BARBARA MURRAY, M.D., DONALD S. BURKE, M.D., TERRENCE A. O'MALLEY, M.D., ALLAN H. GOROLL, M.D., CHARLES H. CAPLAN, M.D., JAMES NOLAN, M.D., BLASE CARABELLO, M.D., AND EVE E. SLATER, M.D.

Table 1. Multivariate Analysis — Preoperative Factors Related to the Development of Postoperative Life-Threatening or Fatal Cardiac Complications.

	FACTORS (IN ORDER OF DECREASING SIGNIFICANCE)	STEPWISE SIGNIFICANCE LEVEL WHEN ADDED TO PREVIOUS FACTORS IN COLUMN
1	S_3 gallop or jugular-vein distention on preoperative examination	P<0.001
2	Myocardial infarction in preceding 6 mo	P<0.001
3	Rhythm other than sinus, or premature atrial contractions on preoperative electrocardiogram	P<0.001
4	>5 premature ventricular contractions/min documented at any time before operation	P<0.001
5	Intraperitoneal, intrathoracic or aortic operation	P<0.001
6	Age >70 yr	P = 0.001
7	Important valvular aortic stenosis	P = 0.007
8	Emergency operation	P = 0.007
9	Poor general medical condition*	P = 0.027

clinically indicated. We defined probably important aortic stenosis as a systolic ejection murmur of at least Grade 2 of 6 accompanied by carotid-artery and cardiac examinations consistent with aortic stenosis and, when available, by a diagnostic cardiac catheterization, an abnormal aortic valve on echocardiography or aortic-valve calcification on chest x-ray study or fluoroscopy. We were not able

Table 2. Univariate Relations between the Independent Risk Variables and Development of Cardiac Complications.

	Risk Factor			Cardiac Complications	
				Life-threatening, but nonfatal*	Cardiac death†
1	3d heart sound or jugular-vein distention:	No	966	34 (3.5)‡	12 (1.2)
		Yes	35	5 (14)	7 (20)
2	Recent infarction:	No	979	36 (3.7)	14 (1.4)
		Yes	22	3 (14)	5 (23)
3	Rhythm other than sinus, or premature atrial contractions on last electrocardiogram:	No	889	28 (3)	9 (1)
		Yes	112	11 (10)	10 (9)
4	>5 premature ventricular contractions/ min at any time:	No	957	32 (3.3)	13 (1.4)
		Yes	44	7 (16)	6 (14)
5	Intraperitoneal, intrathoracic or aortic operation:	No	564	7 (1.2)	8 (1.4)
		Yes	437	32 (7)	11 (2.5)
6	Age >70 yr:	No	677	29 (3)	3 (0.4)
		Yes	324	19 (6)	16 (5)
7	Important valvular aortic stenosis:	No	978	38 (4)	16 (1.6)
		Yes	23	1 (4)	3 (13)

Cardiac Assessment for Patients Undergoing Noncardiac Surgery

A Multifactorial Clinical Risk Index

Allan S. Detsky, MD, PhD; Howard B. Abrams, MD; Nicholas Forbath, MD; J. Gerald Scott, MD; Joseph R. Hilliard, MD

Table 1.—Modified Multifactorial Index

Variables	Points
Coronary artery disease	
Myocardial infarction within 6 mo	10
Myocardial infarction more than 6 mo	5
Canadian Cardiovascular Society angina	
Class 3	10
Class 4	20
Unstable angina within 3 mo	10
Alveolar pulmonary edema	
Within 1 week	10
Ever	5
Valvular disease	
Suspected critical aortic stenosis	20
Arrhythmias	
Sinus plus atrial premature beats or rhythm other than sinus on last preoperative electrocardiogram	5
More than 5 ventricular premature beats at any time prior to surgery	5
Poor general medical status*	5
Age over 70 years	5
Emergency operation	10

Twenty points are added to the index score if the patient is suspected of having critical aortic stenosis. This assessment is made on the basis of classic features in the history (near syncope, exertional angina, or recurrent congestive heart failure) in the setting of other signs (pulsus parvus et tardus, a thrusting left ventricular impulse in the presence of a low blood pressure, and left ventricular hypertrophy).

N = 13 !!!!!

Derivation and Prospective Validation of a Simple Index for Prediction of Cardiac Risk of Major Noncardiac Surgery

Thomas H. Lee, MD, SM; Edward R. Marcantonio, MD, SM; Carol M. Mangione, MD, SM; Eric J. Thomas, MD, SM; Carisi A. Polanczyk, MD; E. Francis Cook, ScD; David J. Sugarbaker, MD; Magruder C. Donaldson, MD; Robert Poss, MD; Kalon K.L. Ho, MD, SM; Lynn E. Ludwig, MS, RN; Alex Pedan, PhD; Lee Goldman, MD, MPH

High risk surgery, ischemic heart disease, history of congestive heart failure, history of CVA, Insulin therapy, elevated creatinine

Only 0.2% participants had aortic stenosis

No mention of other valvular disease

Risk of Patients With Severe Aortic Stenosis Undergoing Noncardiac Surgery

Laurence C. Torsher, MD, Clarence Shub, MD, Steven R. Rettke, MD, and David L. Brown, MD

AJC, 1998

- 19 pts; mean age 75 years
- 28 surgical procedures (22 elective/ 6 emergent; 12 orthopedic, 6 intraabdominal, 4 vascular, 4 urologic, 2 other)
- 26 general anesthesia, 2 continuous spinal
- ASA3 in 14 proc., ASA 3E 1, ASA4 8 and ASA 4E in 5
- 16 symptomatic; mean EF 61%; AVA index < 0.5 cm2/m2 or mean gradient > 50 mmHg

- No intraoperative cardiac events
- 2 deaths (11%)
  - 90 y.o. symptomatic male; emergent laparotomy and SMA embolectomy; MOF 21 days p-op
  - 81 y.o asymptomatic female; elective bilat TKR; periop MI, cardiogenic shock 17 days post-op

However, we have confirmed that selected patients with documented severe AS may undergo noncardiac surgery with reasonable safety, especially considering the advanced age of our patient group.

Patients with aortic stenosis: cardiac complications in non-cardiac surgery

Karen Raymer MD FRCPC,
Homer Yang MD FRCPC

Can J Anes 1998

- Case-control study 55 AS patients (mean AVA 0.9) and 55 controls undergoing NCS
- No significant differences in cardiac complications (5 vs 6)
- One death in AS group

- Small numbers, no data on symptoms
- Only 24 pts with severe AS (AVA < 0.8 cm2)

Cardiac Risk in Patients Aged >75 Years With Asymptomatic, Severe Aortic Stenosis Undergoing Noncardiac Surgery

AJC, 2010

- Case-control study
- 30 asymptomatic pts (mean age 78 yrs) with severe AS (AVA 0.77 cm/2)
- 60 matched controls with mild –moderate AS
- Most pts- intermediate risk surgery

Table 2
Surgical procedures and surgical risk

Variable	Patients (n = 30)	Controls (n = 60)	Overall p Value
Timing of surgery			0.37
Emergency	3 (10%)	3 (5%)	
Elective	27 (90%)	57 (95%)	
Cardiac risk stratification*			0.76
High risk	1 (3%)	3 (5%)	
Vascular surgery†			
Intermediate risk	25 (83%)	46 (77%)	
Orthopedic surgery‡	9 (30%)	9 (15%)	
Abdominal surgery§	3 (10%)	5 (8%)	
Urologic surgery¶	4 (13%)	10 (17%)	
Vascular surgery‖	4 (13%)	3 (5%)	
General surgery#	2 (7%)	8 (13%)	
Miscellaneous**	3 (10%)	11 (18%)	
Low risk	4 (13%)	11 (18%)	
Orthopedic surgery††	0 (0%)	2 (3%)	
Urologic surgery (transrectal prostate biopsy)	1 (3%)	1 (2%)	
Miscellaneous surgery‡‡	3 (10%)	8 (13%)	
American Society of Anesthesiologists score			0.19
1	1 (3%)	0 (0%)	
2	1 (3%)	12 (20%)	
2E	1 (3%)	0 (0%)	
3	19 (63%)	37 (62%)	
3E	1 (3%)	2 (3%)	
4	6 (20%)	8 (13%)	
4E	1 (3%)	1 (2%)	
Anesthesia type			0.91
General	22 (73%)	49 (82%)	
Intravenous sedation	1 (3%)	1 (2%)	
Local	4 (13%)	6 (10%)	
Topical	2 (7%)	3 (5%)	
Regional block/spinal	1 (3%)	1 (2%)	

- 1 death (control group)
- No differences in periop MI (3%)
- No CHF in either group
- Non-significant increase in intraop hypotension in pt group

Effect of Severe Aortic Stenosis on the Outcome in Elderly Patients Undergoing Repair of Hip Fracture

David Leibowitz[a] Gurion Rivkin[b] Jochanan Schiffman[c] David Rott[a]
A. Teddy Weiss[a] Yoav Mattan[b] Leonid Kandel[b]

Departments of [a]Cardiology, [b]Orthopedic Surgery, and [c]Anesthesiology, Hadassah-Hebrew University Medical Center, Jerusalem, Israel

Gerontology, 2008

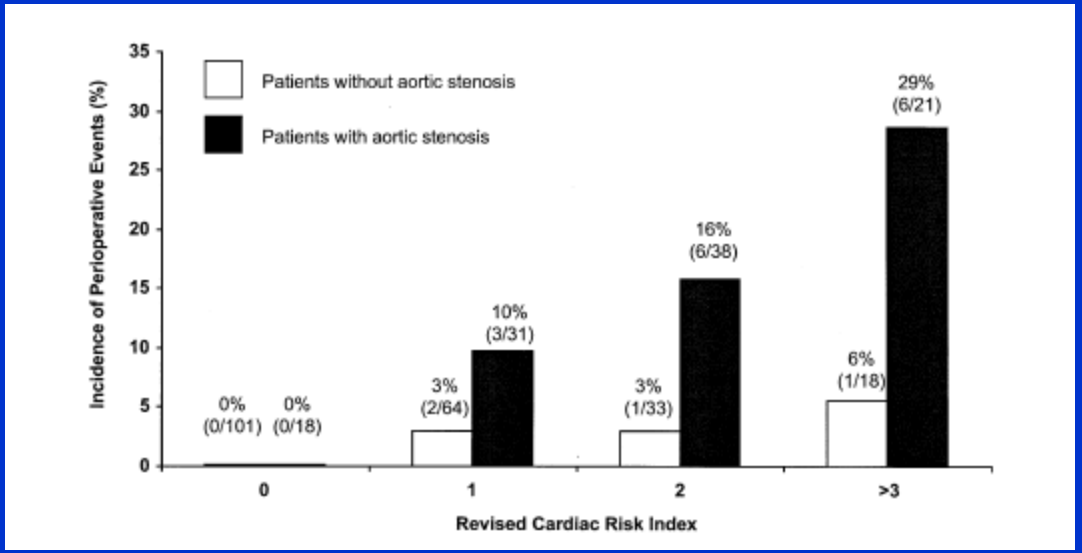
- Case-control study of patients > 70 yrs; urgent repair of hip fx
- Cases (n = 32, mean age 84.5 yrs) mean AVA 0.71 cm2; 6 with reduced EF.
- Controls (n = 88 mean age 86 years)
- Most cases and controls local/regional anesthesia
- No diff in 30-day mortality (6.2 % vs 6.8%)
- Non-sig diff in cardiac complications(18.7% vs 11.8%; p = 0.35)
- No information on symptoms

Aortic Stenosis: An Underestimated Risk Factor for Perioperative Complications in Patients Undergoing Noncardiac Surgery

Miklos D. Kertai, MD, Manolis Bountioukos, MD, Eric Boersma, PhD, Jeroen J. Bax, MD, Ian R. Thomson, MD, Fabiola Sozzi, MD, Jan Klein, MD, Jos R.T.C. Roelandt, MD, Don Poldermans, MD

AJM, 2004

- 108 pts with moderate (n = 92) or severe (n = 16) AS
- 20% symptomatic; 40% with LVEF < 50%
- 216 controls



OR 5.2 (95% CI 1.6-17)

Table 1. Characteristics of Patients with Aortic Stenosis and Controls

Characteristic	Patients with Aortic Stenosis (n = 108)	Patients without Aortic Stenosis (n = 216)	*P* Value
	Number (%) or Mean ± SD		
Age (years)	69.0 ± 10.3	56.6 ± 18.0	<0.001
Age >70 years	61 (57)	62 (29)	<0.001
Male sex	55 (51)	119 (56)	0.47
History of angina	26 (24)	24 (11)	<0.01
History of myocardial infarction	27 (25)	29 (13)	0.01
History of heart failure	30 (28)	6 (3)	<0.001
History of cerebrovascular disease	20 (19)	18 (8)	0.01
Diabetes mellitus	26 (24)	20 (9)	<0.001
Renal failure (serum creatinine ≥2 mg/dL)	22 (20)	13 (6)	<0.001
Revised Cardiac Risk Index ≥1*	90 (83)	115 (53)	<0.001
Hypertension	66 (61)	66 (31)	<0.001
Pulmonary disease	22 (20)	29 (13)	0.10
Smoking	30 (29)	70 (33)	0.52
Medication			
Aspirin	15 (14)	26 (12)	0.72
ACE inhibitor	55 (51)	51 (24)	<0.001
Beta-blocker	31 (29)	43 (20)	0.09
Diuretic	35 (32)	26 (12)	<0.001
Nitrates	22 (20)	16 (7)	0.001
Statin	18 (16)	21 (10)	0.10

Perioperative Risk of Noncardiac Surgery Associated With Aortic Stenosis

Maliha Zahid, MD[a,*], Ali F. Sonel, MD[a,b], Samir Saba, MD[a], and Chester B. Good, MD, MPh[a,b]

AJC, 2005

- Retrospective national database
- 1996-2002
- 5,149 patients with AS; 10,248 controls undergoing non-cardiac surgery
- ICD-9 codes, no hemodynamic data

Table 1
Demographic and clinical variables in patients with AS and controls

Variable	Patients with AS (n = 5,149)	Controls (n = 10,248)	p Value
Age (yrs)	76.2 ± 0.19	75.7 ± 0.13	0.07
Men	2,986 (58.0%)	6,049 (58.8%)	0.33
Women	2,163 (42.0%)	4,235 (41.2%)	
Coronary artery disease	772 (15.0%)	1,038 (10.1%)	<0.001
Congestive heart failure	1,522 (29.6%)	1,620 (15.8%)	<0.001
Hypertension	1,206 (23.4%)	2,778 (27.0%)	<0.001
Diabetes mellitus	540 (10.5%)	1,226 (11.9%)	0.008
Length of stay (d)	8.3 ± 0.11	7.9 ± 0.09	0.006
Surgical risk			
Low	3,073 (59.7%)	6,132 (59.6%)	0.99
Intermediate	1,823 (35.4%)	3,646 (35.5%)	
High	253 (4.9%)	506 (4.9%)	
AMI	199 (3.9%)	209 (2.0%)	<0.001
Death	277 (5.4%)	589 (5.7%)	0.38
Death or myocardial infarction	427 (8.3%)	738 (7.2%)	0.01

Table 3
Significant multivariate predictors of adverse postoperative outcome

Clinical Characteristic	Odds Ratio	95% Confidence Interval	p Value
Age >65 yrs	1.58	1.13–2.23	0.008
Coronary artery disease	1.52	1.17–1.97	0.002
Congestive heart failure	2.72	2.21–3.34	<0.001
Hypertension	0.42	0.31–0.57	<0.001
Diabetes mellitus	0.71	0.49–1.01	0.06
AS	1.55	1.26–1.89	<0.001

- Presence of AS predictive of nonfatal MI only
- No difference in mortality

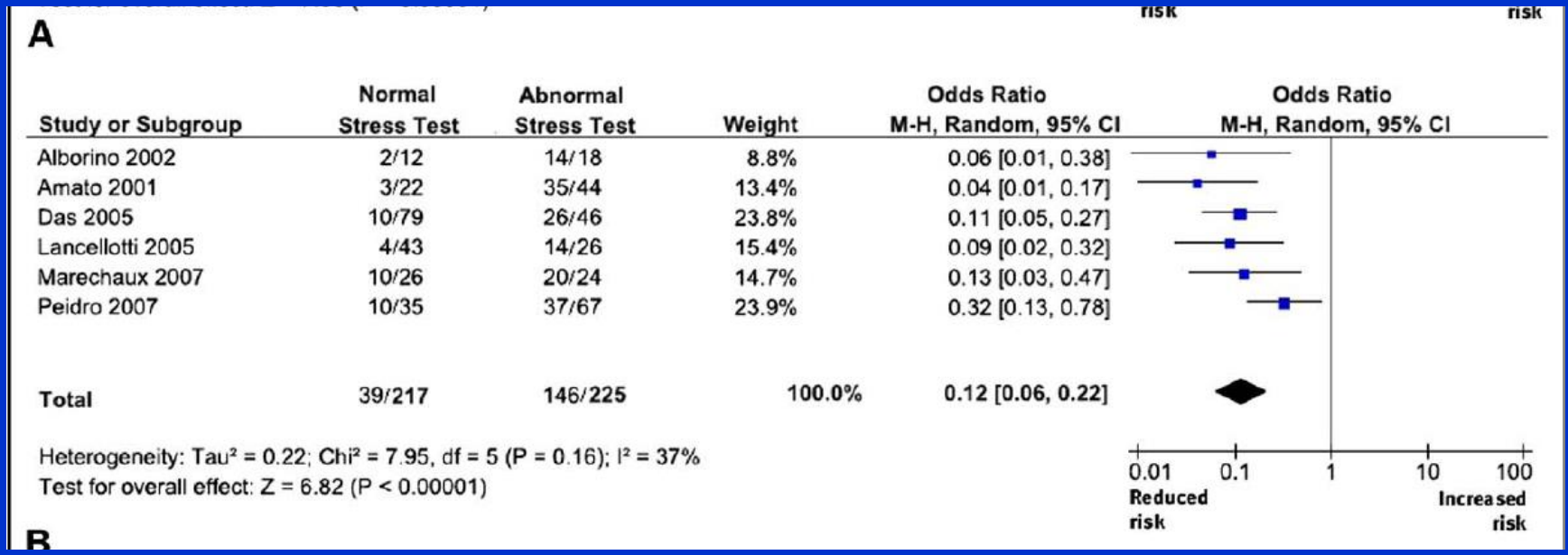
Can we improve risk assessment before NCS in AS patients?

AVR should be considered in asymptomatic patients with severe AS and abnormal exercise test showing fall in blood pressure below baseline.	IIa	C

Meta-Analysis of Prognostic Value of Stress Testing in Patients With Asymptomatic Severe Aortic Stenosis

Asim M. Rafique, MD[a], Simon Biner, MD[a,b], Indraneil Ray, MD[a], James S. Forrester, MD[a], Kirsten Tolstrup, MD[a], and Robert J. Siegel, MD[a,*]

AJC, 2009



BNP

- Levels correlates with increased ventricular volume/pressure
- Prognostic indicator in MI, CHF, valvular disease
- May be a more physiologic pre-operative assessment
- Rapid, bedside, quantitative kit available
- Results should not delay surgery

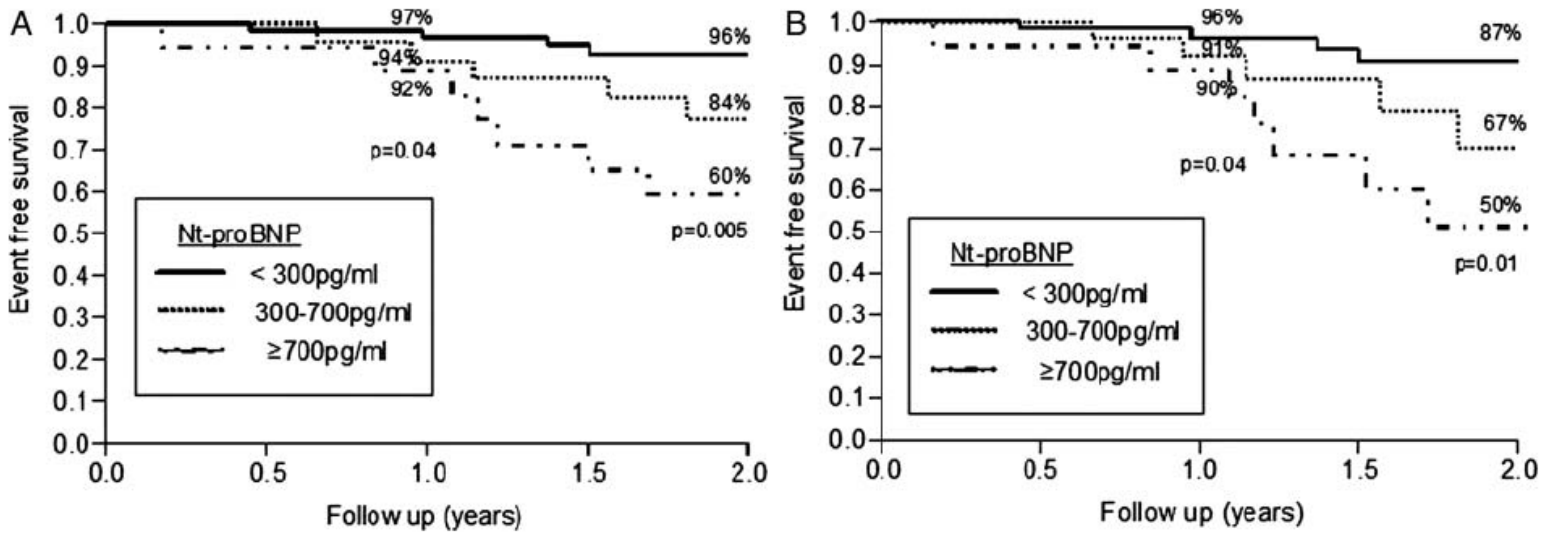


Figure 4 Survival free of aortic valve stenosis (AS)-related events in the 142 asymptomatic patients (sudden death, congestive heart failure or new AS-related onset of symptoms (dyspnoea, angina or syncope)) according to N-terminal fragment of proB-type natriuretic peptide (Nt-proBNP) values (normal<300 pg/ml, intermediate between 300 and 700 pg/ml and high>700 pg/ml) (A) overall and (B) in the subgroup of moderate and severe AS (N=102).

AVR may be considered in asymptomatic patients with severe AS, normal EF and none of the above mentioned exercise test abnormalities, if surgical risk is low, and one or more of the following findings is present: • Markedly elevated natriuretic peptide levels confirmed by repeated measurements and without other explanations	IIb	C

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Biomarkers

The Predictive Ability of Pre-Operative B-Type Natriuretic Peptide in Vascular Patients for Major Adverse Cardiac Events

An Individual Patient Data Meta-Analysis

Reitze N. Rodseth, MBChB, MMed,* Giovana A. Lurati Buse, MD,† Daniel Bolliger, MD,† Christoph S. Burkhart, MD,† Brian H. Cuthbertson, MBChB, MD,‡ Simon C. Gibson, MBChB, MD,§ Elisabeth Mahla, MD,‖ David W. Leibowitz, MD,¶ Bruce M. Biccard, MBChB, MMed Sci, PhD*

Durban, South Africa; Basel, Switzerland; Toronto, Ontario, Canada; Glasgow, United Kingdom; Graz, Austria; and Jerusalem, Israel

Table 4 AUCs for BNP and the RCRI in Predicting Perioperative Outcomes (n = 632)

	BNP		RCRI	
Outcome	AUC (%)	95% CI (%)	AUC (%)	95% CI (%)
MACEs	80.5	75.1–85.8	64.5	56.6–72.3
Cardiac death	80.0	71.5–88.6	67.1	53.8–80.5
Nonfatal MI	78.6	72.2–85.5	62.3	52.8–71.7
All-cause mortality	71.4	60.7–82.2	63.8	53.2–74.3

AUC = area under the receiver-operating characteristic curve; BNP = B-type natriuretic peptide; CI = confidence interval; MI = myocardial infarction; other abbreviations as in Table 3.

European Heart Journal (2013) **34**, 853–862
doi:10.1093/eurheartj/ehs445

CLINICAL RESEARCH
Prevention and epidemiology

Incremental value of high-sensitive troponin T in addition to the revised cardiac index for peri-operative risk stratification in non-cardiac surgery

Michael Weber[1,2*], Andreas Luchner[3], Seeberger Manfred[4], Christian Mueller[4], Christoph Liebetrau[1], Axel Schlitt[5], Svetlana Apostolovic[6], Radmilo Jankovic[6], Dragic Bankovic[7], Marina Jovic[7], Veselin Mitrovic[1], Holger Nef[1], Helge Mollmann[1], and Christian W. Hamm[1]

- 979 patients prior to “major” NCS undergoing GA
- At least 1 cardiovascular risk factor
- 2.6% mortality

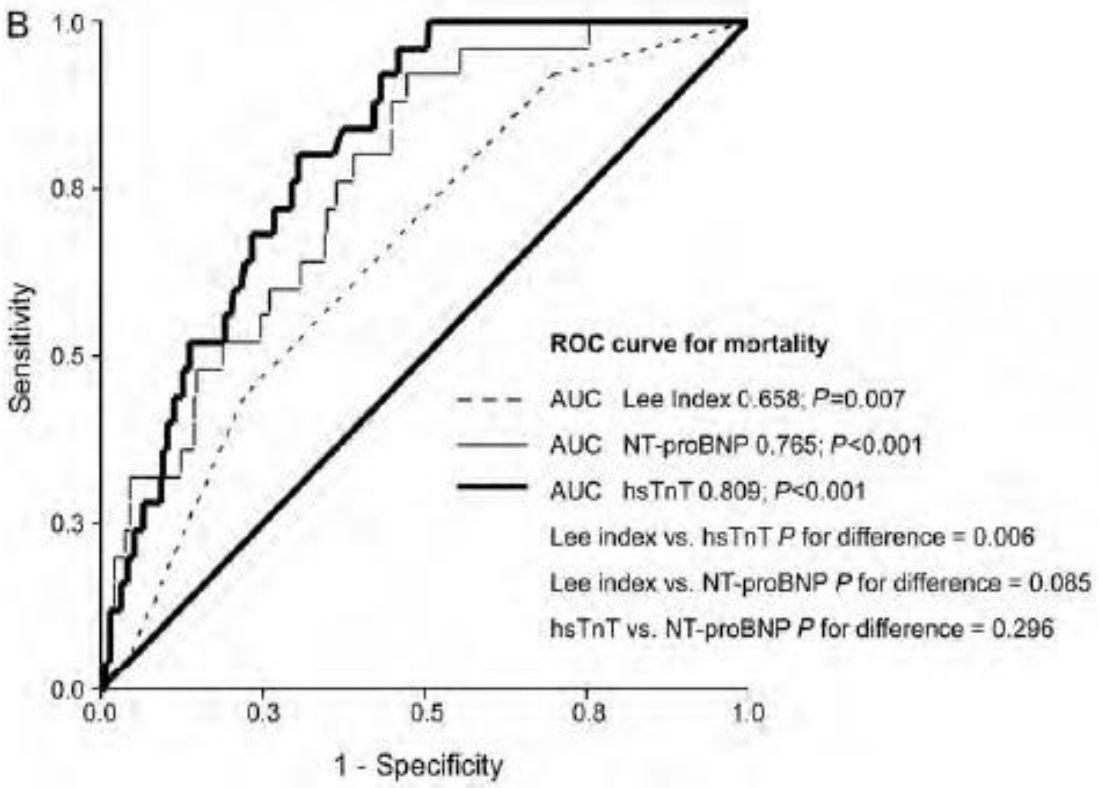

B
1.0
0.8
0.5
0.3
0.0
Sensitivity
0.0
0.3
0.5
0.8
1.0
1 - Specificity
ROC curve for mortality
AUC Lee Index 0.658; P=0.007
AUC NT-proBNP 0.765; P<0.001
AUC hsTnT 0.809; P<0.001
Lee index vs. hsTnT P for difference = 0.006
Lee index vs. NT-proBNP P for difference = 0.085
hsTnT vs. NT-proBNP P for difference = 0.296

Table 5 Multivariate Cox regression analyses

	B	Wald	*P*-value	HR	95% CI	
					Lower	Upper
hsTnT >14 ng/L	0.96	6.86	0.0088	2.60	1.27	5.31
Lee score ≥2	0.64	3.04	0.0812	1.89	0.92	3.88
Systolic blood pressure (mmHg)	−0.01	1.41	0.2347	0.99	0.98	1.01
NYHA class II–IV	0.62	3.12	0.0774	1.87	0.93	3.73

PREDICTORS OF OUTCOME IN SEVERE, ASYMPTOMATIC AORTIC STENOSIS

RAPHAEL ROSENHEK, M.D., THOMAS BINDER, M.D., GEROLD PORENTA, M.D., IRENE LANG, M.D., GÜNTHER CHRIST, M.D., MICHAEL SCHEMPER, PH.D., GERALD MAURER, M.D., AND HELMUT BAUMGARTNER, M.D.

NEJM, 2000

TABLE 2. RESULTS OF UNIVARIATE AND MULTIVARIATE ANALYSIS OF CLINICAL AND ECHOCARDIOGRAPHIC PREDICTORS OF OUTCOME.*

VARIABLE	NO. OF PATIENTS WITH VARIABLE (%)	UNIVARIATE ANALYSIS		MULTIVARIATE ANALYSIS	
		P VALUE	RISK RATIO (95% CI)	P VALUE	RISK RATIO (95% CI)
Age >50 yr	93 (74)	<0.001	2.7 (1.5–5.2)	NS	1.1 (0.5–2.6)
Female sex	59 (47)	NS	0.9 (0.7–1.2)	NS	0.9 (0.7–1.2)
Coronary artery disease	33 (26)	<0.05	1.7 (1.0–2.9)	NS	1.1 (0.6–1.9)
Hypertension	44 (35)	NS	0.9 (0.5–1.5)	NS	0.6 (0.4–1.1)
Diabetes	23 (18)	<0.05	1.9 (1.0–3.3)	NS	1.3 (0.7–2.5)
Hypercholesterolemia	69 (55)	NS	1.2 (0.7–2.0)	NS	1.0 (0.6–1.7)
Aortic-jet velocity ≥4.5 m/sec	64 (51)	NS	1.3 (0.8–2.1)	NS	1.1 (0.7–1.9)
Aortic-valve calcification score 3 or 4†	101 (80)	<0.001	5.2 (2.4–13.5)	<0.01	4.6 (1.6–14.0)

*Data are for 126 of the 128 patients; the remaining 2 patients were lost to follow-up. CI denotes confidence interval, and NS denotes not significant. Risk ratios are for the occurrence of an event (death or valve replacement).

†A score of 3 indicated moderate calcification, and a score of 4 heavy calcification.

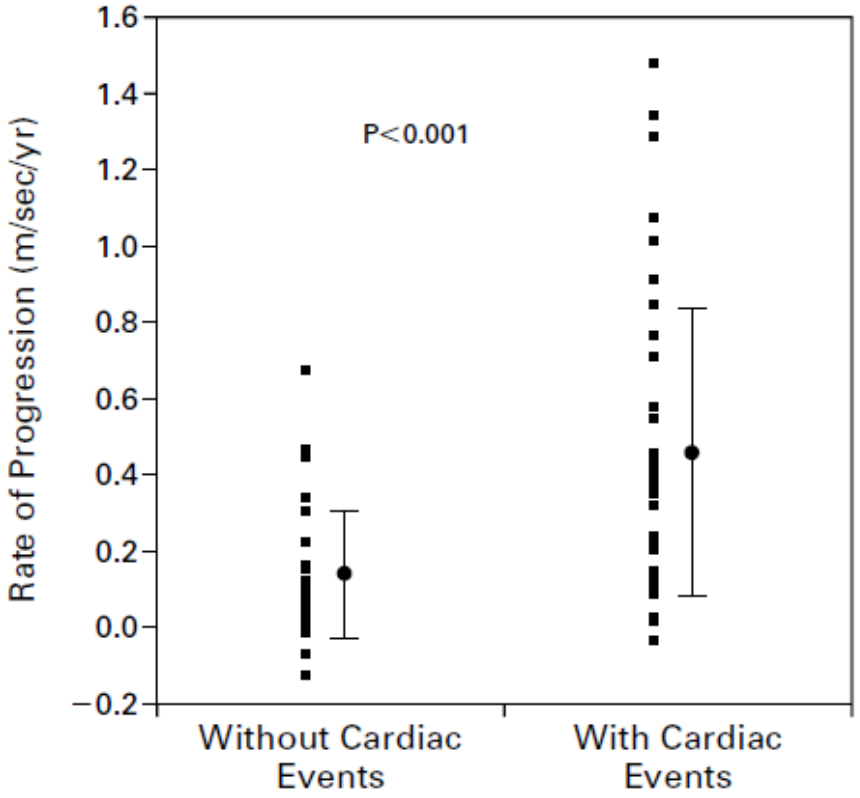


Figure 4. Mean Rate of Progression of Aortic-Jet Velocity among 41 Patients Who Had Cardiac Events and 29 Who Did Not. The bars represent means ±SD.

Surgical predictors

High (Reported cardiac risk often greater than 5%)
- Emergent major operations, particularly in the elderly
- Aortic and other major vascular surgery
- Peripheral vascular surgery
- Anticipated prolonged surgical procedures associated with large fluid shifts and/or blood loss

Intermediate (Reported cardiac risk generally less than 5%)
- Carotid endarterectomy
- Head and neck surgery
- Intraperitoneal and intrathoracic surgery
- Orthopedic surgery
- Prostate surgery

Low† (Reported cardiac risk generally less than 1%)
- Endoscopic procedures
- Superficial procedure
- Cataract surgery
- Breast surgery

Clinical predictors

Major

Unstable coronary syndromes

- Acute or recent myocardial infarction* with evidence of important ischemic risk by clinical symptoms or noninvasive study
- Unstable or severe† angina (Canadian class III or IV)‡

Decompensated heart failure

Significant arrhythmias

- High-grade atrioventricular block
- Symptomatic ventricular arrhythmias in the presence of underlying heart disease
- Supraventricular arrhythmias with uncontrolled ventricular rate

Severe valvular disease

Intermediate

Mild angina pectoris (Canadian class I or II)

Previous myocardial infarction by history or pathological Q waves

Compensated or prior heart failure

Diabetes mellitus (particularly insulin-dependent)

Renal insufficiency

Minor

Advanced age

Abnormal ECG (left ventricular hypertrophy, left bundle-branch block, ST-T abnormalities)

Rhythm other than sinus (e.g., atrial fibrillation)

Low functional capacity (e.g., inability to climb one flight of stairs with a bag of groceries)

History of stroke

Uncontrolled systemic hypertension

Can we reduce risk prior to NCS?

Pre-op BAV

- Roth et al. JACC, 1989
  - 7 pts, no compl
- Levine et al. AJC, 1988
  - 7 pts, no compl
- Hayes SN et al. Mayo Clin Proc, 1989
  - 9 pts, one death

Pre-op TAVI

7.3. Prophylactic Valvular Intervention Before Noncardiac Surgery

There is little information about the appropriateness of valvular repair or replacement before a noncardiac surgical

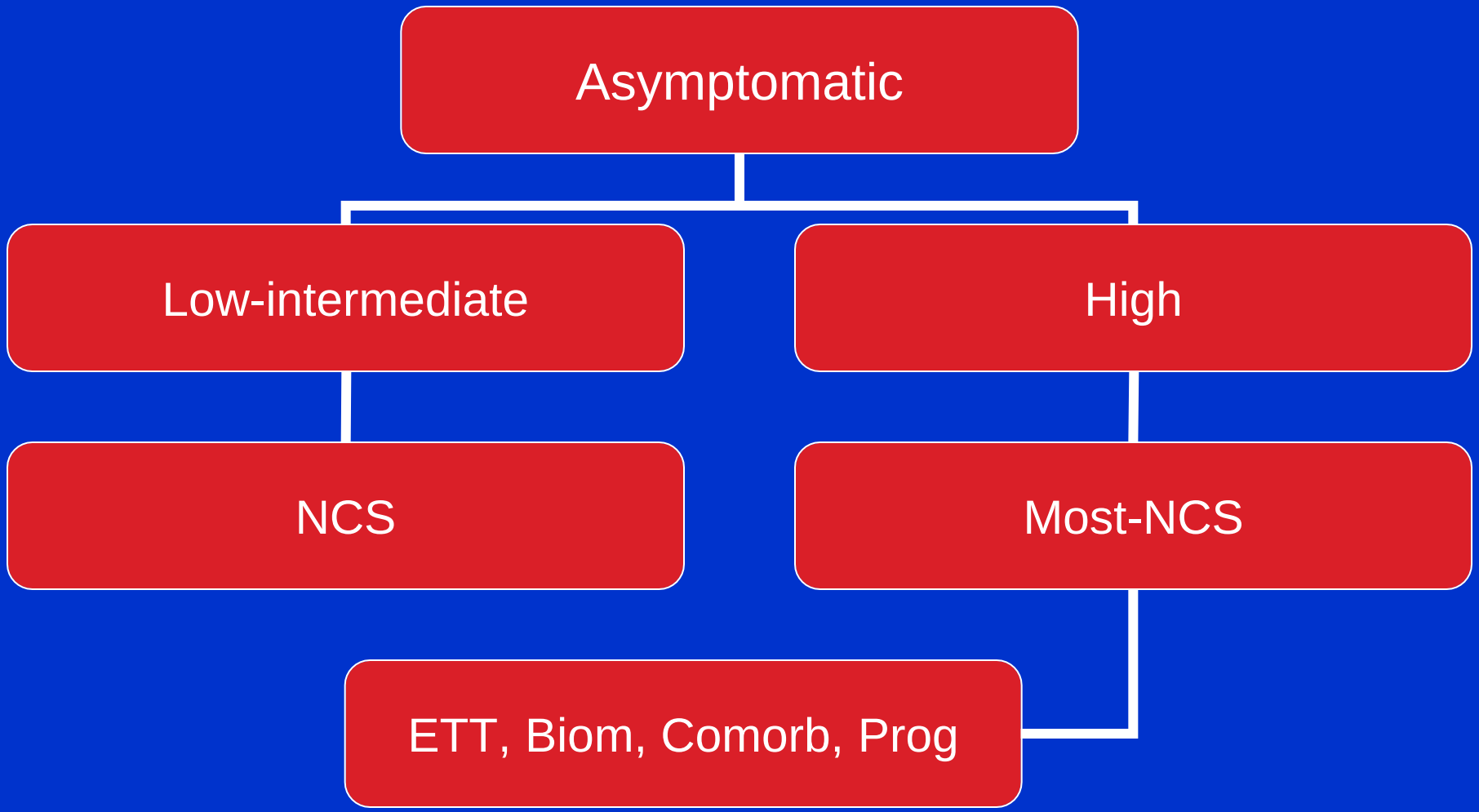
ACC/AHA perioperative guidelines, 2007

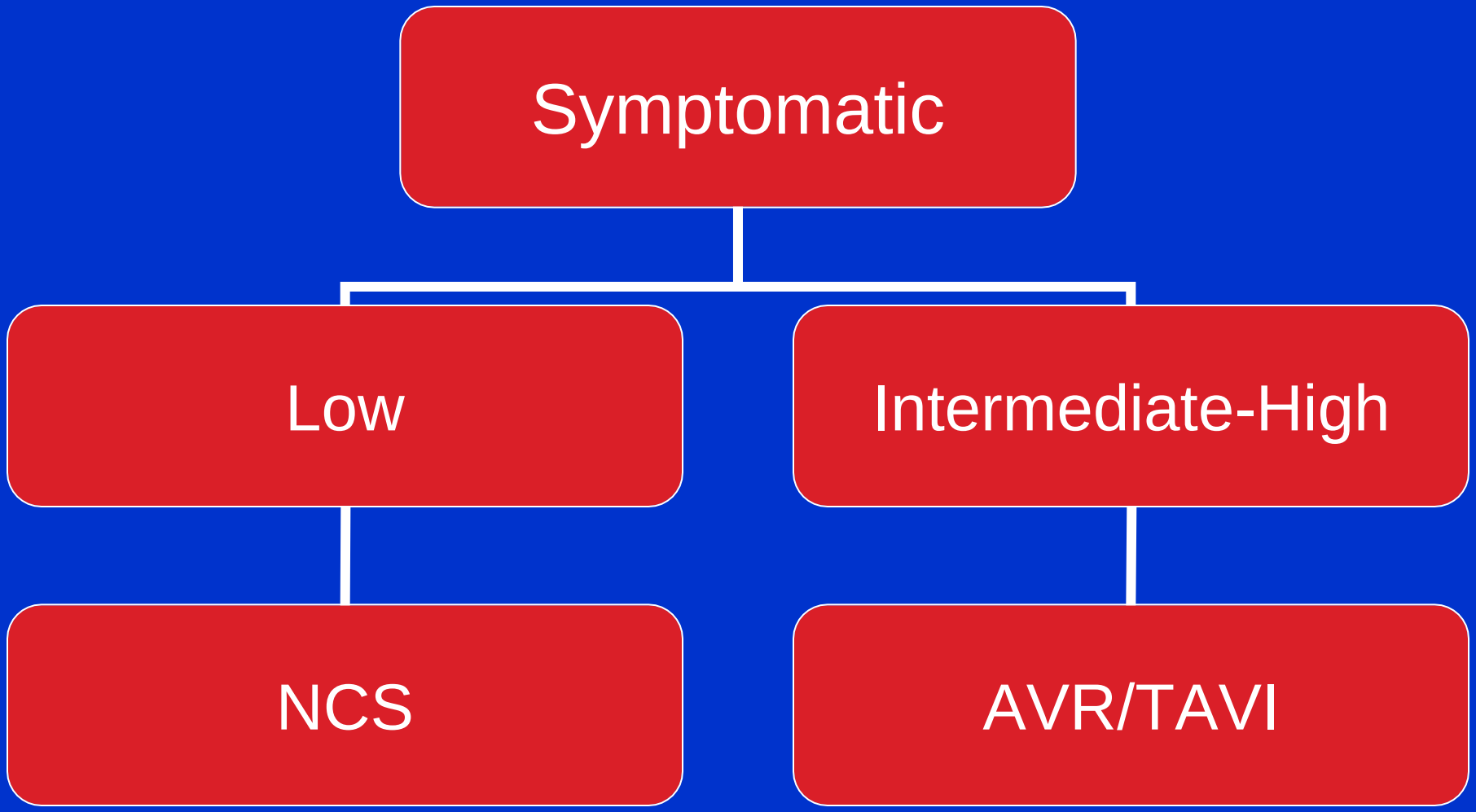
Beta blockers

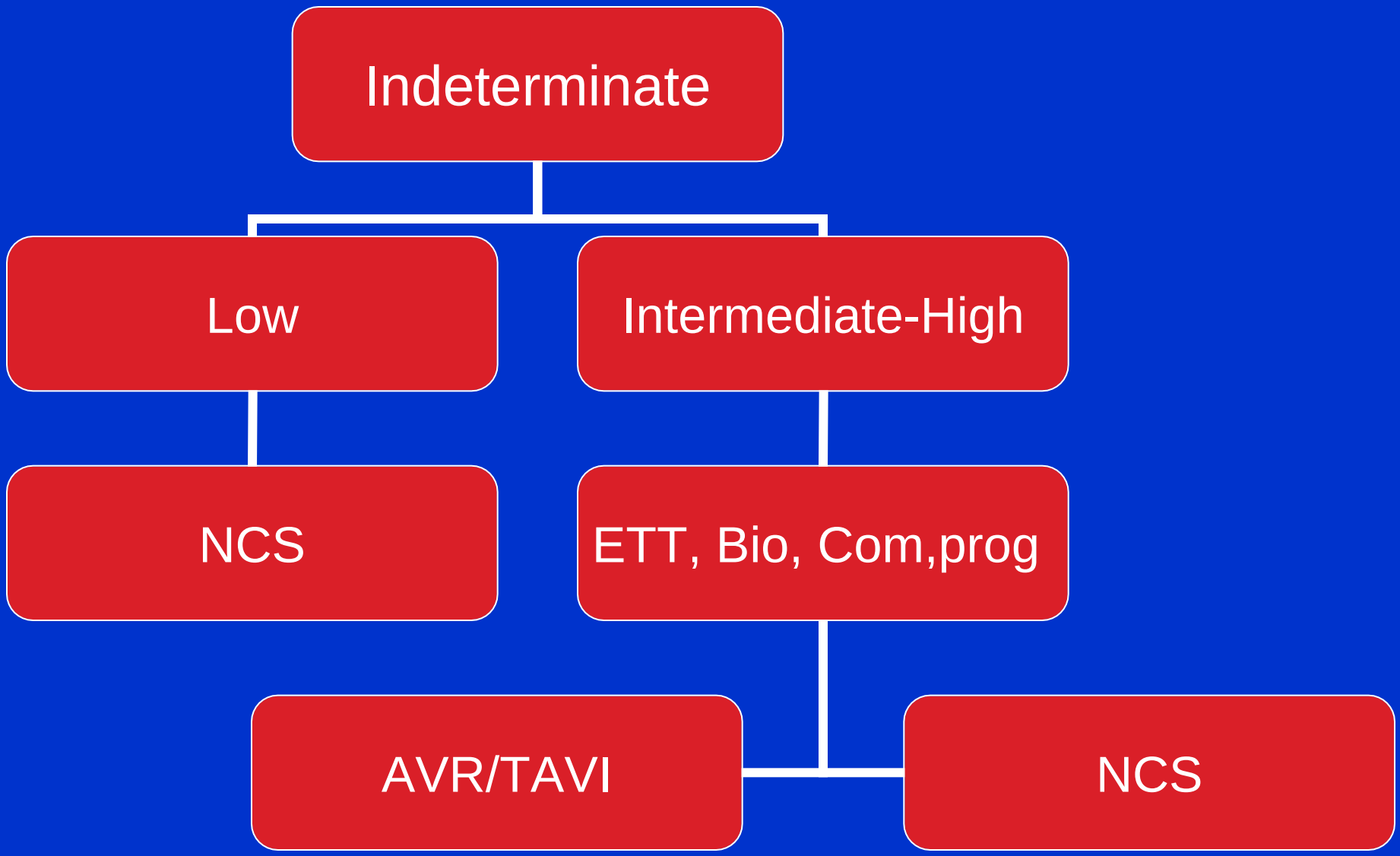
Table 2 Summary of recommendations on perioperative β-blockers. Both guidelines recommend to start treatment with β-blockers early [optimally 30 days or at least 1 week before surgery (ESC), or days to weeks before surgery (ACCF/AHA)] and to titrate β-blockade to HR of 60–70 beats min^{-1} (ESC) or 60–80 beats min^{-1} (ACCF/AHA). β-Blocker should be omitted if SAP is not >100 mm Hg (ESC), or if there is hypotension (level not defined; ACCF/AHA). Table reproduced from Sear and Foex[81] with permission

ESC guideline August 2009	ACCF/AHA guideline November 2009
Class I	Class I
β-Blockers recommended in patients	β-Blockers recommended in patients
With known ischaemic heart disease or myocardial ischaemia on preoperative testing (I B)	Who are receiving β-blockers for treatment of conditions with ACC/AHA Class I indication for the drug (I C)
Undergoing high-risk surgery (I B)	
Who were previously treated with β-blockers because of IHD, arrhythmias, or hypertension (I C)	
Class II	Class II
β-Blockers should be considered in patients	β-Blockers are probably recommended in patients
Undergoing intermediate-risk surgery (IIb B)	Undergoing vascular surgery who suffer from coronary artery disease or show ischaemia on preoperative testing (IIa B)
Previously treated with β-blockers because of chronic heart failure with systolic dysfunction (IIa C)	In the presence of coronary artery disease or high cardiac risk (more than one risk factor) who are undergoing intermediate-risk surgery (IIa B)
Undergoing low-risk surgery with risk factor(s) (IIb B)	Where preoperative assessment for vascular surgery identifies high cardiac risk (more than one risk factor; IIa C)
	The usefulness of β-blockers is uncertain in patients
	Undergoing vascular surgery with no risk factors who are not currently taking β-blockers (IIb B)
	Undergoing either intermediate-risk procedures or vascular surgery with a single clinical risk factor in the absence of coronary artery disease (IIb C)
Class III	Class III
β-Blockers not recommended	β-Blockers not to be given
Perioperative high-dose β-blockers without titration (III A)	High-dose β-blockers without titration are not useful and may be harmful to patients not currently taking β-blockers who are undergoing surgery (III B)
Patients undergoing low-risk surgery without risk factors (III B)	Patients undergoing surgery who have an absolute contraindication to β-blockade (III C)

- Normal sinus rhythm
- Heart rate between 60-80
- Adequate systemic resistance
- Maintain intravascular volume
- Invasive monitoring


Asymptomatic
Low-intermediate
High
NCS
Most-NCS
ETT, Biom, Comorb, Prog


Symptomatic
Low
Intermediate-High
NCS
AVR/TAVI


Indeterminate
Low
Intermediate-High
NCS
ETT, Bio, Com,prog
AVR/TAVI
NCS


MCHUMOR
by T. McCracken
"Off hand, I'd say you're suffering from an arrow through your head, but just to play it safe, I'm ordering a bunch of tests."