Post operative Myocardial Infarctions: What are the new options for diagnosis, prevention and treatment?

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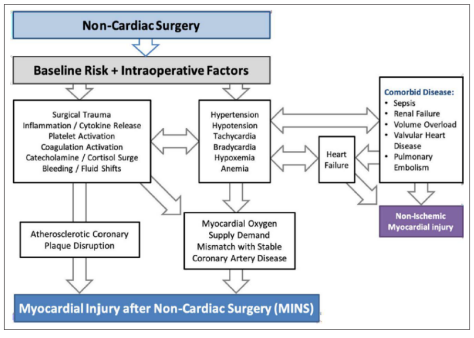
Disclosures

None

Post Op MI



Circulation. 2021;144:e287–e305. DOI: 10.1161/CIR.0000000000001024

Post Op MI

Demographics
Increased age[1,15,19–22]
Male sex[23]
Functional capacity
Duke Activity Status Index score[24,25]
Atherosclerosis-associated comorbidities
Hypertension[1,7]
Diabetes[1,7,26,40,41]
CAD[1,7,24,42]
Peripheral artery disease[1,15,23,43]
Cerebrovascular disease[15]
Other cardiovascular conditions
Heart failure[1,7]
Atrial fibrillation[1,7]
Other comorbidities
Chronic renal insufficiency (eGFR <60 mL·min^{-1}·1.73 m^{-2})[1,7,20,26,38,41]
Untreated severe obstructive sleep apnea[44]
Composite risk indices
Elevated Revised Cardiac Risk Index score[26,27,42]
High-risk STOP-Bang risk score[25]
Preoperative testing
Elevated natriuretic peptide concentration[20,26,42]
Neutrophil-lymphocyte ratio >4[45]
Elevated casual blood glucose concentration[41]
Elevated reticulated platelet concentration[46]
Reversibility on myocardial perfusion testing[47,48]
Impaired postexercise heart rate recovery[21,49]
Surgery type
Emergency surgery[1,7,50]
Surgical procedure type[1,20–22,42,49]

CAD indicates coronary artery disease; eGFR, estimated glomerular filtration rate; MINS, myocardial injury after noncardiac surgery; and STOP-Bang, snoring, tiredness, observed apnea, hypertension, body mass index, age, neck circumference, and male sex.

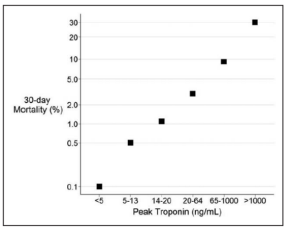


Figure 4. Thirty-day mortality as a function of postoperative peak high-sensitivity troponin T.

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Retrospective review of state-wide collaborative data (MI) from Jan 2011 to June 2018.

Procedures captured:

- Carotid endarterectomy (CEA)
- Carotid stenting (CAS)
- Open peripheral bypass
- Open abdominal aortic aneurysm repair (oAAA)
- EVAR

Patient demographics and hospital level characteristics captured.

N = 26,231 patients

- poMI: 410
- No poMI: 25,821
- Overall POMI rate: 1.6%

Beaulieu R, etal. *JAMA-Surg 2020*

Impact of POMI

These patients had high compliance with evidenced based poMI guidelines.

AHA/ACC guidelines for NSTEMI medical management:

- Statin therapy: Preop 83.6%, Discharge 89.7%
- Beta-blockade: Preop 70%, Discharge 84.0%
- Antiplatelet: Preop 84%, Discharge 95%

Impact of POMI

One year mortality rate was significantly higher among patients experiencing a POMI (37.4 vs 5.1%, p<0.001).

Open AAA and peripheral bypass are the "highest" of the high risk procedures.

AAA: 3.75%
Peripheral bypass: 2.56%

Mortality (one year):
41.2%
45.3%

POMI *strongly* associated with all-cause one year mortality.
OR 5.62 (CI 4.04-7.84, p<0.001)

Cardiac Preop Risk Calculation

- Risk factors to consider
- Calculators

American Heart Association. | AMERICAN COLLEGE of CARDIOLOGY

2013 Prevention Guidelines Tools

CV RISK CALCULATOR

The Vascular Quality Initiative Cardiac Risk Index for prediction of myocardial infarction after vascular surgery

- N = 88,791
- Logistic regression and validation
- Most are non-modifiable!

(J Vasc Surg 2016;64:1411-21.)

Table II. Variables associated with postoperative myocardial infarction (POMI) in stepwise logistic regression analysis for Vascular Quality Initiative (VQI) all-procedures model (2012-2014)

Risk factor	Coefficient	SE[a]	OR	P value[a]
Intercept	−5.82	0.14	—	—
Procedure				
CEA (referent)	0	—	—	—
EVAR	0.17	0.16	1.2	.2901
INFRA	1.12	0.09	3.1	<.0001
SUPRA	1.60	0.15	4.9	<.0001
OAAA	1.91	0.13	6.7	<.0001
Age, years				
<60 (referent)	0	—	—	—
60-69	0.44	0.13	1.6	.0006
70-79	0.64	0.13	1.9	<.0001
≥80	1.10	0.14	3.0	<.0001
Creatinine				
≤1.8 mg/dL	0	—	—	—
>1.8 mg/dL	0.76	0.11	2.1	<.0001
On dialysis	0.64	0.16	1.9	<.0001
Stress test				
Not performed (referent)	0	—	—	—
Normal	−0.15	0.09	0.9	.0967
Abnormal	0.46	0.11	1.6	<.0001
CAD				
None	0	—	—	—
Asymptomatic	0.40	0.09	1.5	<.0001
Symptomatic	0.76	0.09	2.1	<.0001
Diabetes				
None (referent)	0	—	—	—
Diet controlled	0.18	0.15	1.2	.2251
Noninsulin medication	0.20	0.08	1.2	0152
Insulin	0.39	0.09	1.5	<.0001
CHF				
None (referent)	0	—	—	—
Asymptomatic	0.44	0.10	1.5	<.0001
Symptomatic	0.50	0.13	1.7	<.0001

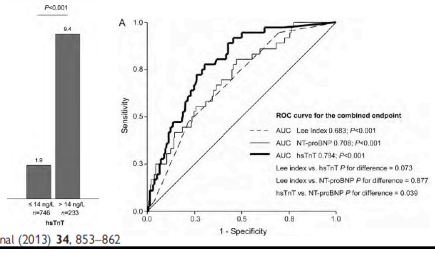
Is there additional biomarker information to be gained to help stratify patients?

Biomarkers

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]

N = 979 prospective surgical patients



European Heart Journal (2013) **34**, 853–862

Preoperative *N*-Terminal Pro–B-Type Natriuretic Peptide and Cardiovascular Events After Noncardiac Surgery
A Cohort Study

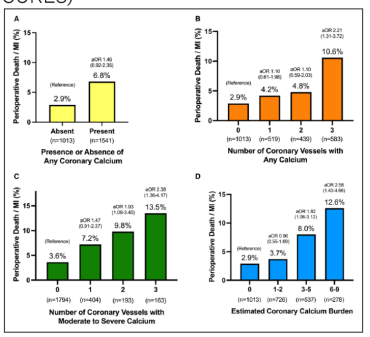
Table 2. Incidence of 30-Day Outcomes, by Preoperative NT-proBNP Values*

Variable	All Patients (n = 10 402)	Preoperative NT-proBNP Threshold			
		<100 pg/mL (n = 5356)	100 to <200 pg/mL (n = 1843)	200 to <1500 pg/mL (n = 2608)	≥1500 pg/mL (n = 595)
Composite of vascular death or MINS					
Events, n (incidence [95% CI], %)†	1269 (12.2 [11.6-12.8])	278 (5.2 [4.6-5.8])	226 (12.3 [10.8-13.8])	542 (20.8 [19.2-22.3])	223 (37.5 [33.5-41.3])
Adjusted HR (95% CI)	–	1.00	2.27 (1.90-2.70)	3.63 (3.13-4.21)	5.82 (4.81-7.05)
Composite of all-cause mortality or MI					
Events, n (incidence [95% CI], %)†	446 (4.3 [3.9-4.7])	92 (1.7 [1.4-2.1])	55 (3.0 [2.2-3.8])	205 (7.9 [6.8-8.9])	94 (15.8 [12.8-18.7])
Adjusted HR (95% CI)	–	1.00	1.57 (1.12-2.19)	2.64 (2.03-4.69)	5.35 (3.91-7.34)
MINS					
Events, n (incidence [95% CI], %)†	1237 (11.9 [11.3-12.5])	272 (5.1 [4.5-5.7])	223 (12.1 [10.6-13.6])	529 (20.3 [18.7-21.8])	213 (35.8 [31.9-39.6])
Adjusted HR (95% CI)	–	1.00	2.29 (1.91-2.73)	3.62 (3.12-4.21)	5.70 (4.69-6.92)
MI					
Events, n (incidence [95% CI], %)†	378 (3.6 [3.3-4.0])	82 (1.5 [1.2-1.9])	46 (2.5 [1.8-3.2])	175 (6.7 [5.7-7.7])	75 (12.6 [9.9-15.3])
Adjusted HR (95% CI)	–	1.00	1.47 (1.02-2.10)	3.46 (2.64-4.53)	4.68 (3.32-6.60)
All-cause mortality					
Events, n (incidence [95% CI], %)†	88 (0.8 [0.7-1.0])	14 (0.3 [0.1-0.4])	13 (0.7 [0.3-1.1])	37 (1.4 [1.0-1.9])	24 (4.0 [2.4-5.6])
Adjusted HR (95% CI)	–	1.00	2.41 (1.13-5.14)	4.12 (2.20-7.73)	8.40 (4.10-17.23)
Vascular death					
Events, n (incidence [95% CI], %)†	54 (0.5 [0.4-0.7])	11 (0.2 [0.1-0.3])	8 (0.4 [0.1-0.7])	18 (0.7 [0.4-1.0])	17 (2.9 [1.5-4.2])
Adjusted HR (95% CI)	–	1.00	1.84 (0.74-4.59)	2.41 (1.11-5.21)	6.75 (2.90-15.70)

Ann Intern Med. doi:10.7326/M19-2501

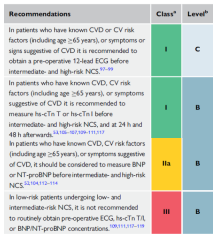
Existing Nongated CT Coronary Calcium Predicts Operative Risk in Patients Undergoing Noncardiac Surgeries (ENCORES)

- Institutional study from 2016-20
- N = 2554 pts with RCRI = 1
- All with non con CT chest
- Scoring 0-3 blinded
- Validated
- MCE

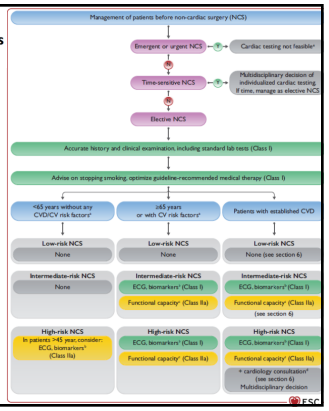


Circulation. 2023;148:1154–1164.

2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery

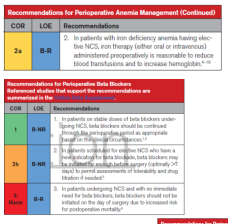


Recommendations	Class[a]	Level[b]
In patients who have known CVD or CV risk factors (including age ≥65 years), or symptoms or signs suggestive of CVD it is recommended to obtain a pre-operative 12-lead ECG before intermediate- and high-risk NCS.[97–99]	I	C
In patients who have known CVD, CV risk factors (including age ≥65 years), or symptoms suggestive of CVD it is recommended to measure hs-cTn T or hs-cTn I before intermediate- and high-risk NCS, and at 24 h and 48 h afterwards.[53,106–107,109–112,117]	I	B
In patients who have known CVD, CV risk factors (including age ≥65 years), or symptoms suggestive of CVD, it should be considered to measure BNP or NT-proBNP before intermediate- and high-risk NCS.[53,104,112–114]	IIa	B
In low-risk patients undergoing low- and intermediate-risk NCS, it is not recommended to routinely obtain pre-operative ECG, hs-cTn T/I, or BNP/NT-proBNP concentrations.[109,111,115–118]	III	B



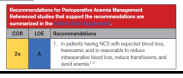
European Heart Journal (2022) **43**, 3826–3924

2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

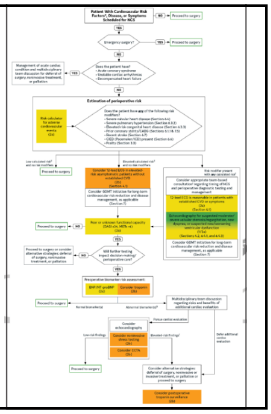


Recommendations for Perioperative Anemia Management (Continued)		
COR	LOE	Recommendations
2a	B-R	2. In patients with iron deficiency anemia having elective NCS, iron therapy (either oral or intravenous) administered preoperatively is reasonable to reduce blood transfusions and to increase hemoglobin.[4–16]

Recommendations for Perioperative Beta Blockers Referenced studies that support the recommendations are summarized in the Online Data Supplement		
COR	LOE	Recommendations
I	B-NR	1. In patients on stable doses of beta blockers undergoing NCS, beta blockers should be continued through the perioperative period as appropriate based on the clinical circumstances.[1,2]
2b	B-NR	2. In patients scheduled for elective NCS who have a new indication for beta blockers, beta blockers may be initiated long enough before surgery (optimally >7 days) to permit assessments of tolerability and dose titration if needed.[3]
3: Harm	B-R	3. In patients undergoing NCS and with no immediate need for beta blockers, beta blockers should not be initiated on the day of surgery due to increased risk for postoperative mortality.[4]



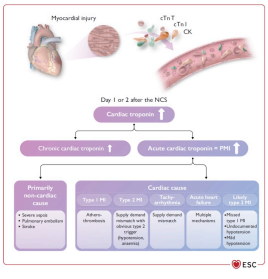
Recommendations for Perioperative Anemia Management Referenced studies that support the recommendations are summarized in the Online Data Supplement		
COR	LOE	Recommendations
2a	A	1. In patients having NCS with expected blood loss, tranexamic acid is reasonable to reduce intraoperative blood loss, reduce transfusions, and avoid anemia.[1–7]

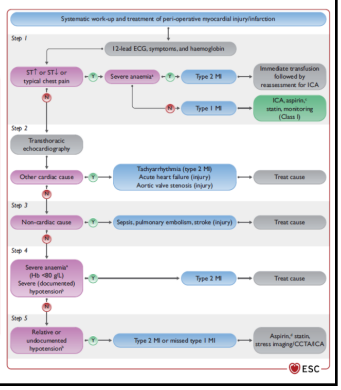


Circulation. 2024;150:e00–e00.

What if a post operative MI occurs?

2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery





European Heart Journal (2022) **43**, 3826–3924

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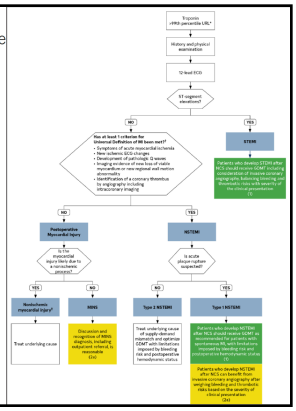
Recommendations for Myocardial Injury After Noncardiac Surgery Surveillance and Management (Continued)		
COR	LOE	Recommendations
3: No benefit	B-NR	2. In patients undergoing low-risk NCS, routine post-operative screening with cTn levels is not indicated without signs or symptoms suggestive of myocardial ischemia or MI.[10]
MINS Management		
2a	B-NR	3. In patients who develop MINS, especially in those not previously known to have excess cardiovascular risk, outpatient follow-up is reasonable for optimization of cardiovascular risk factors.[47–49]
2b	C-LD	4. In patients who develop MINS, antithrombotic therapy may be considered to reduce thromboembolic events.[47]

Recommendations for Management of Postoperative STEMI/NSTEMI Referenced studies that support the recommendations are summarized in the Online Data Supplement		
COR	LOE	Recommendations
I	B-NR	1. Patients who develop STEMI after NCS should be considered for GDMT, including consideration of ICA, balancing bleeding and thrombotic risks with the severity of the clinical presentation.[1–3]

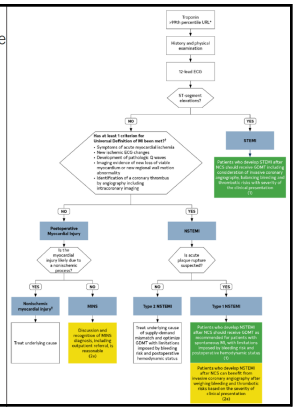


Circulation. 2024;150:e00–e00.

2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Recommendations for Management of Postoperative STEMI/NSTEMI (Continued)

COR	LOE	Recommendations
1	C-EO	2. Patients who develop NSTEMI after NCS should receive medical therapy as recommended for patients with spontaneous MI but after consideration of postoperative bleeding risks and hemodynamic status.
2a	C-LD	3. Patients who develop NSTEMI after NCS can be considered for ICA, balancing bleeding and thrombotic risks with the severity of clinical presentation.[12]



Circulation. 2024;150:e80–e00.

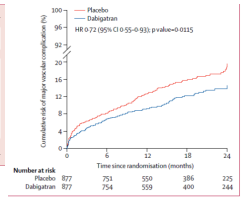
Dabigatran in patients with myocardial injury after non-cardiac surgery (MANAGE): an international, randomised, placebo-controlled trial

- RCT of po MI patients, to placebo or Dabigitran by POD 2
- N = 877 per arm

	Dabigatran (n=877)	Placebo (n=877)	Hazard ratio (95% CI)	p value
Primary efficacy outcome:				
Composite of vascular mortality and non-fatal myocardial infarction, non-haemorrhagic stroke, peripheral arterial thrombosis, amputation, and symptomatic venous thromboembolism	37 (11%)	133 (15%)	0·72 (0·55–0·93)	0·0115
Secondary efficacy outcomes				
Vascular mortality	52 (6%)	64 (7%)	0·80 (0·56–1·16)	–
All-cause mortality	100 (11%)	110 (13%)	0·90 (0·69–1·18)	–
Myocardial infarction	35 (4%)	43 (5%)	0·80 (0·51–1·26)	–
Cardiac revascularisation procedure	37 (4%)	21 (2%)	1·53 (0·88–2·65)	–
Non-haemorrhagic stroke	2 (<1%)	10 (1%)	0·20 (0·04–0·90)	–
Peripheral arterial thrombosis	0	4 (<1%)	–	–
Amputation	18 (2%)	26 (3%)	0·70 (0·38–1·27)	–
Symptomatic venous thromboembolism	8 (1%)	17 (2%)	0·47 (0·20–1·08)	–
Readmission to hospital for vascular reasons	113 (13%)	139 (15%)	0·81 (0·62–1·11)	–

Data are n (%) unless otherwise indicated.

Table 2: Efficacy outcomes



Lancet 2018; 391: 2325–34

Figure 2: Kaplan-Meier estimates of the primary efficacy outcome
HR=hazard ratio.

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Restrictive or Liberal Transfusion Strategy in Myocardial Infarction and Anemia

J.L. Carson, M.M. Brooks, P.C. Hébert, S.G. Goodman, M. Bertolet, S.A. Glynn, B.R. Chaitman, T. Simon, R.D. Lopes, A.M. Goldsweig, A.P. DeFilippis, J.D. Abbott, B.J. Potter, F.M. Carrier, S.V. Rao, H.A. Cooper, S. Ghafghazi, D.A. Fergusson, W.J. Kostis, H. Noveck, S. Kim, M. Tessalee, G. Ducrocq, P. Gabriel Melo de Barros e Silva, D.J. Triulzi, C. Alsweiler, M.A. Menegus, J.D. Neary, L. Uhl, J.B. Strom, C.B. Fordyce, E. Ferrari, J. Silvain, F.O. Wood, B. Daneault, T.S. Polonsky, M. Senaratne, E. Puymirat, C. Bouleti, B. Lattuca, H.D. White, S.F. Kelsey, P.G. Steg, and J.H. Alexander, for the MINT Investigators*

Take away – probably transfuse to ~ 10 gm/dL in those with MI

Thank you

Questions?

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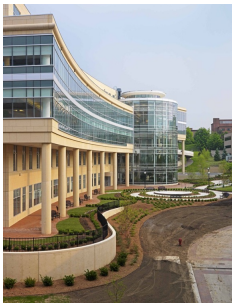

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