

Myocardial Injury After Noncardiac Surgery

Intraoperative teaching · CA-3

THE QUESTION

Where the evidence disagrees

This topic was selected because an evidence synthesis beats a textbook on it: the trials disagree, or the guidance has moved recently.

THE EVIDENCE

What each source contributes, and how strong it is

Study design first — a cohort and a randomised trial do not carry the same weight.

Design	Year	Journal	What it found
Randomised trial	2018	England)	In patients with myocardial injury after noncardiac surgery, dabigatran 110 mg twice
Cohort	2017	JAMA	A peak postoperative high-sensitivity troponin T of 20 to under 65 ng/L with a rise
Cohort	2018	Anesthesia and analgesia	Maximum intraoperative heart rate >100 bpm is associated with increased risk of
Review	2023	Journal of clinical anesthesia	Many determinants of myocardial injury after noncardiac surgery, such as
Cohort	2023	The Canadian journal of cardiology	Diagnostic thresholds are assay-specific
Cohort	2023	Clinical chemistry	With the ADVIA Centaur high-sensitivity troponin I assay a peak of 75 ng/L or above

6 resolved citations behind this deck; every point above traces to one of them.

WHAT THE TRIALS FOUND

In patients with myocardial injury after noncardiac surgery, dabigatran 110 mg twice

Randomised trial · England)

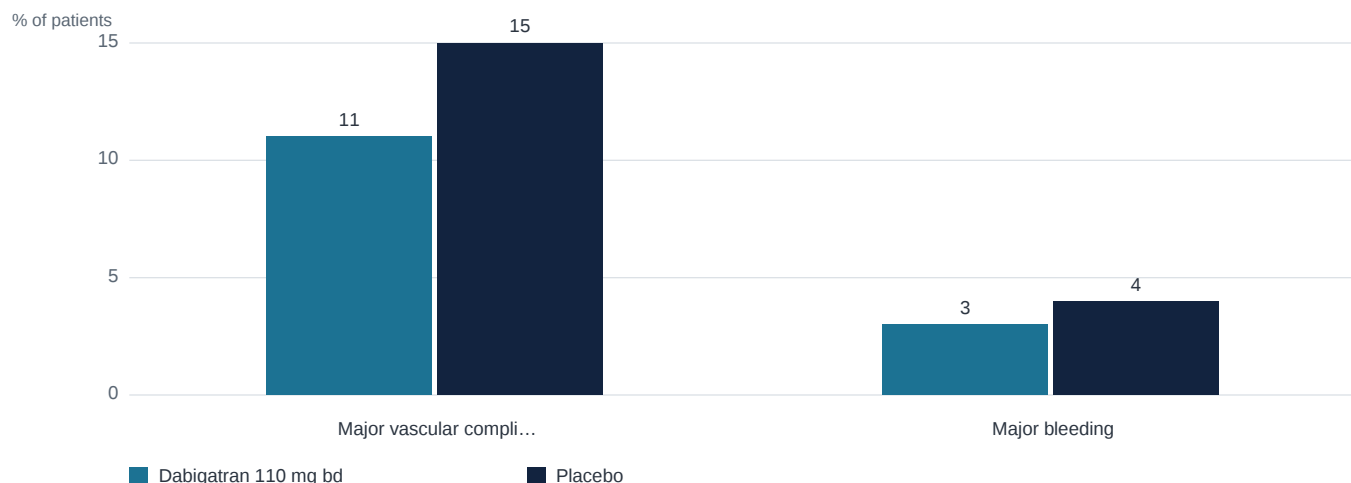
In patients with myocardial injury after noncardiac surgery, dabigatran 110 mg twice daily reduced major vascular complications from 15% to 11% with no significant increase in major bleeding.

Dabigatran in Patients With Myocardial Injury After Non-Cardiac Surgery (MANAGE): An International, Randomised, Placebo-Controlled Trial, Lancet (London, England) 2018 · PMID 29900874

THE NUMBERS

MANAGE: dabigatran lowered vascular complications

1,754 patients with myocardial injury after noncardiac surgery.



The only trial showing a treatment that changes the course of MINS, without a significant bleeding penalty.

Dabigatran in Patients With Myocardial Injury After Non-Cardiac Surgery (MANAGE): An International, Randomised, Placebo-Controlled Trial, Lancet (London, England) 2018 · PMID 29900874

IN PRACTICE

What the cohorts and reviews add

5 findings, each on the slide that follows.

JAMA 2017

A peak postoperative high-sensitivity troponin T of 20 to under 65 ng/L with a rise

A peak postoperative high-sensitivity troponin T of 20 to under 65 ng/L with a rise of at least 5 ng/L, or 65 ng/L and above, predicts 30-day...

ANESTHESIA AND ANALGESIA 2018

Maximum intraoperative heart rate >100 bpm is associated with increased risk of

Maximum intraoperative heart rate >100 bpm is associated with increased risk of myocardial injury, myocardial infarction

JOURNAL OF CLINICAL ANESTHESIA 2023

Many determinants of myocardial injury after noncardiac surgery, such as

Many determinants of myocardial injury after noncardiac surgery, such as pre-existing coronary disease, cannot be changed; haemodynamic control,...

THE CANADIAN JOURNAL OF CARDIOLOGY 2023

Diagnostic thresholds are assay-specific

Diagnostic thresholds are assay-specific: with the Abbott high-sensitivity troponin I assay, a peak of 60 ng/L or above carried more than a...

IN PRACTICE

A peak postoperative high-sensitivity troponin T of 20 to under 65 ng/L with a rise

Cohort · JAMA

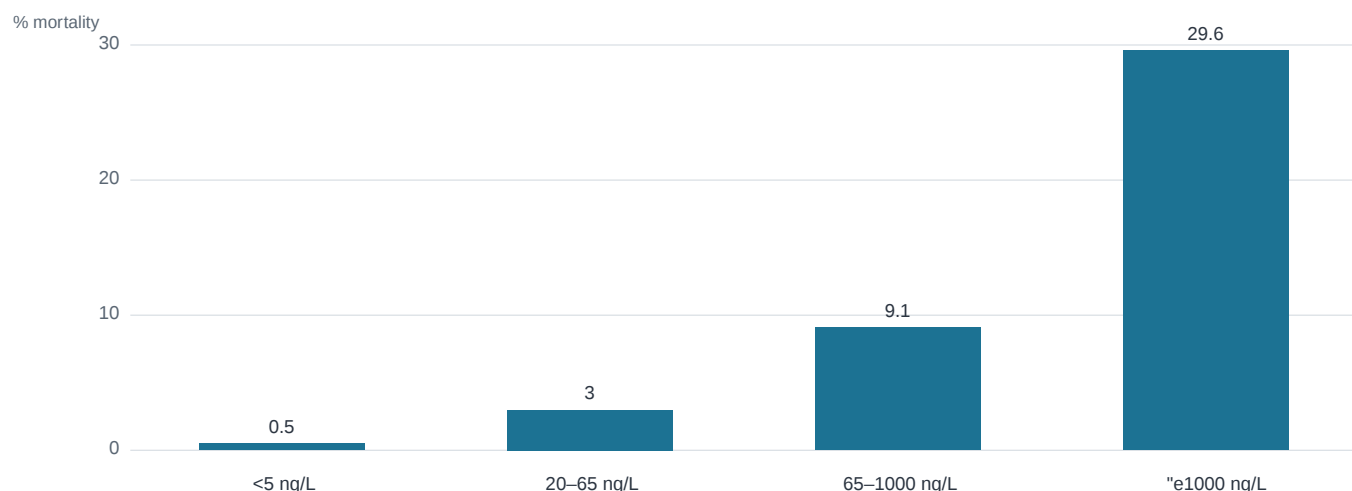
A peak postoperative high-sensitivity troponin T of 20 to under 65 ng/L with a rise of at least 5 ng/L, or 65 ng/L and above, predicts 30-day mortality even with no ischaemic symptom or ECG change — and 93% of these patients had no symptom at all.

Association of Postoperative High-Sensitivity Troponin Levels With Myocardial Injury and 30-Day Mortality Among Patients Undergoing Noncardiac Surgery, JAMA 2017 · PMID 28444280

THE NUMBERS

Troponin predicts death without any ischaemic symptom

30-day mortality by peak postoperative high-sensitivity troponin T.



93% of these patients had no ischaemic symptom at all — without routine measurement they are invisible.

Association of Postoperative High-Sensitivity Troponin Levels With Myocardial Injury and 30-Day Mortality Among Patients Undergoing Noncardiac Surgery, JAMA 2017 · PMID 28444280

IN PRACTICE

Maximum intraoperative heart rate >100 bpm is associated with increased risk of

Cohort · Anesthesia and analgesia

Maximum intraoperative heart rate >100 bpm is associated with increased risk of myocardial injury, myocardial infarction, and mortality after noncardiac surgery.

A Prospective International Multicentre Cohort Study of Intraoperative Heart Rate and Systolic Blood Pressure and Myocardial Injury After Noncardiac Surgery: Results of the VISION Study, Anesthesia and analgesia 2018 · PMID 29077608

IN PRACTICE

Many determinants of myocardial injury after noncardiac surgery, such as

Review · Journal of clinical anesthesia

Many determinants of myocardial injury after noncardiac surgery, such as pre-existing coronary disease, cannot be changed; haemodynamic control, oxygen supply and metabolic homeostasis are the modifiable ones to act on.

Perioperative Strategies to Reduce Risk of Myocardial Injury After Non-Cardiac Surgery (MINS): A Narrative Review, Journal of clinical anesthesia 2023 · PMID 36931053

IN PRACTICE

Diagnostic thresholds are assay-specific

Cohort · The Canadian journal of cardiology

Diagnostic thresholds are assay-specific: with the Abbott high-sensitivity troponin I assay, a peak of 60 ng/L or above carried more than a seven-fold increase in major cardiac events and death at 30 days.

High-Sensitivity Cardiac Troponin I Thresholds to Identify Myocardial Injury After Noncardiac Surgery: A Cohort Study, The Canadian journal of cardiology 2023 · PMID 36682485

IN PRACTICE

With the ADVIA Centaur high-sensitivity troponin I assay a peak of 75 ng/L or above

Cohort · Clinical chemistry

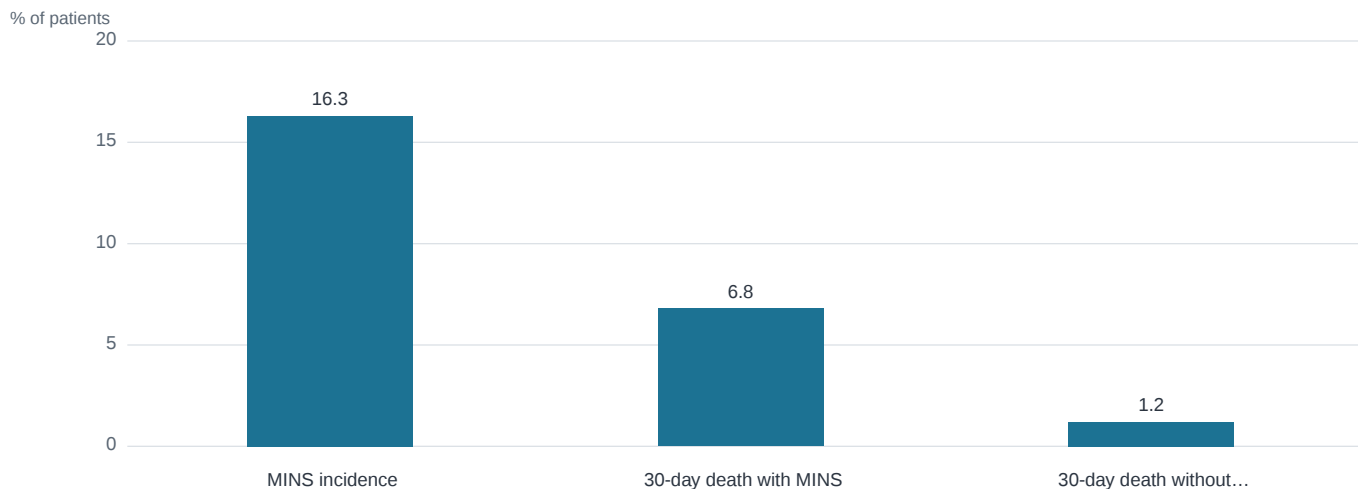
With the ADVIA Centaur high-sensitivity troponin I assay a peak of 75 ng/L or above carried a more than five-fold increase in 30-day major cardiovascular events, and predicted them whether or not ischaemic features were present.

High-Sensitivity Troponin I Predicts Major Cardiovascular Events After Non-Cardiac Surgery: A Vascular Events in Non-Cardiac Surgery Patients Cohort Evaluation (VISION) Substudy, Clinical chemistry 2023 · PMID 36762424

THE NUMBERS

One in six after major general surgery, and mostly silent

Incidence and 30-day mortality, 4,490 patients.



Crude 30-day mortality was 6.8% with myocardial injury against 1.2% without; after adjustment the odds ratio was 4.7. 90% would have gone undetected without routine troponin.

IN THE ROOM

What this changes about the next case

Colour is the strength of the evidence behind each step, not the urgency.

- 1 In patients with myocardial injury after noncardiac surgery, dabigatran 110 mg twice daily reduced major vascular complications from 15% to 11% with no significant increase in major bleeding.
- 2 A peak postoperative high-sensitivity troponin T of 20 to under 65 ng/L with a rise of at least 5 ng/L, or 65 ng/L and above, predicts 30-day mortality even with no ischaemic symptom or ECG change — and 93% of these patients had no symptom at all.
- 3 Maximum intraoperative heart rate >100 bpm is associated with increased risk of myocardial injury, myocardial infarction, and mortality after noncardiac surgery.
- 4 Diagnostic thresholds are assay-specific: with the Abbott high-sensitivity troponin I assay, a peak of 60 ng/L or above carried more than a seven-fold increase in major cardiac events and death at 30 days.
- 5 With the ADVIA Centaur high-sensitivity troponin I assay a peak of 75 ng/L or above carried a more than five-fold increase in 30-day major cardiovascular events, and predicted them whether or not ischaemic features were present.

KEY TAKEAWAYS

What to carry into the next case

In patients with myocardial injury after noncardiac surgery, dabigatran 110 mg twice
England) 2018

A peak postoperative high-sensitivity troponin T of 20 to under 65 ng/L with a rise
JAMA 2017

Maximum intraoperative heart rate >100 bpm is associated with increased risk of
Anesthesia and analgesia 2018

Many determinants of myocardial injury after noncardiac surgery, such as
Journal of clinical anesthesia 2023

In patients with myocardial injury after noncardiac surgery, dabigatran 110 mg twice

QUESTIONS I'LL ASK YOU IN THE ROOM

1. How would you teach this to a CA-1 in two minutes?
2. Where does the evidence for this actually stop?
3. What would you do differently in a resource-limited setting?
4. Defend the alternative you decided against.

ORAL BOARDS STEM

A 72-year-old with diabetes and peripheral vascular disease had an uneventful femoral-popliteal bypass. On the first postoperative day a screening high-sensitivity troponin is elevated. He has no chest pain and the ECG is unchanged.

BOARD QUESTIONS

1. In the large cohort study of postoperative high-sensitivity troponin T after noncardiac surgery, state the peak troponin patterns that predicted 30-day mortality, and state what proportion of these patients had any symptom.
2. In the prospective international multicentre VISION cohort of intraoperative haemodynamics, what maximum intraoperative heart rate threshold was linked to myocardial injury, myocardial infarction and mortality after noncardiac surgery? State how strong that link can be claimed to be.
3. A resident asks for the single troponin number that defines myocardial injury after noncardiac surgery. Explain why one number cannot be given, and state what the cohort study using the Abbott high-sensitivity troponin I assay found at its threshold.
4. The MANAGE trial studied dabigatran in patients with myocardial injury after noncardiac surgery. State the dose, the effect on major vascular complications with the actual event rates, and what happened to major bleeding. Then state what this evidence does and does not establish.

ANSWER KEY

1. **A peak postoperative high-sensitivity troponin T of 20 to under 65 ng/L accompanied by a rise of at least 5 ng/L, or a peak of 65 ng/L and above, predicted 30-day mortality — and it did so even when there was no ischaemic symptom and no ECG change. 93% of these patients had no symptom at all.**

Ninety-three percent of these patients had no symptom at all, which is why the troponin has to be measured rather than waited for.
Association of Postoperative High-Sensitivity Troponin Levels With Myocardial Injury and 30-Day Mortality Among Patients Undergoing Noncardiac Surgery, JAMA 2017 · PMID 28444280

2. **A maximum intraoperative heart rate above 100 bpm was associated with increased risk of myocardial injury, myocardial infarction, and mortality after noncardiac surgery. Because this is a prospective cohort study, the finding is an association only — it does not establish that the tachycardia caused the injury, nor that treating heart rate down below 100 prevents it.**

A maximum intraoperative heart rate over 100 is associated with myocardial injury, infarction and death — an observed association in a cohort, not proof that treating the number changes the outcome.

A Prospective International Multicentre Cohort Study of Intraoperative Heart Rate and Systolic Blood Pressure and Myocardial Injury After Noncardiac Surgery: Results of the VISION Study, Anesthesia and analgesia 2018 · PMID 29077608

3. **Diagnostic thresholds are assay-specific, so no single number transfers between laboratories. With the Abbott high-sensitivity troponin I assay specifically, a peak of 60 ng/L or above carried more than a seven-fold increase in major cardiac events and death at 30 days. That figure is a cohort association tied to that one assay and that 30-day endpoint, not a universal cut-off.**

Sixty ng/L means something on the Abbott high-sensitivity troponin I assay and nothing on anyone else's — the threshold belongs to the assay, not to the diagnosis.

High-Sensitivity Cardiac Troponin I Thresholds to Identify Myocardial Injury After Noncardiac Surgery: A Cohort Study, The Canadian journal of cardiology 2023 · PMID 36682485

4. **Dabigatran 110 mg twice daily reduced major vascular complications from 15% to 11% with no significant increase in major bleeding. This is a single international randomised placebo-controlled trial: it demonstrates that effect within that trial, but on its own a four-percentage-point reduction in one trial is a trial result, not a recommendation to anticoagulate these patients as a matter of course.**

One randomised trial moved major vascular complications from 15% to 11% without significantly more major bleeding — that is a trial result, not yet a standing instruction.

Dabigatran in Patients With Myocardial Injury After Non-Cardiac Surgery (MANAGE): An International, Randomised, Placebo-Controlled Trial, Lancet (London, England) 2018 · PMID 29900874

In patients with myocardial injury after noncardiac surgery, dabigatran 110 mg twice

SOURCES

- [1] Dabigatran in Patients With Myocardial Injury After Non-Cardiac Surgery (MANAGE): An International, Randomised, Placebo-Controlled Trial, Lancet (London, England) 2018 · PMID 29900874
- [2] Association of Postoperative High-Sensitivity Troponin Levels With Myocardial Injury and 30-Day Mortality Among Patients Undergoing Noncardiac Surgery, JAMA 2017 · PMID 28444280
- [3] A Prospective International Multicentre Cohort Study of Intraoperative Heart Rate and Systolic Blood Pressure and Myocardial Injury After Noncardiac

Surgery: Results of the VISION Study, Anesthesia and analgesia 2018 · PMID 29077608

[4] Perioperative Strategies to Reduce Risk of Myocardial Injury After Non-Cardiac Surgery (MINS): A Narrative Review, Journal of clinical anesthesia 2023 · PMID 36931053

[5] High-Sensitivity Cardiac Troponin I Thresholds to Identify Myocardial Injury After Noncardiac Surgery: A Cohort Study, The Canadian journal of cardiology 2023 · PMID 36682485

[6] High-Sensitivity Troponin I Predicts Major Cardiovascular Events After Non-Cardiac Surgery: A Vascular Events in Non-Cardiac Surgery Patients Cohort Evaluation (VISION) Substudy, Clinical chemistry 2023 · PMID 36762424

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APPROVED