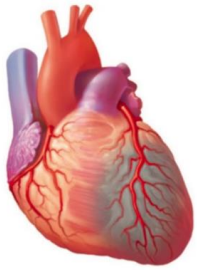
Troponin auf der ICU/IMCU

friend or foe?



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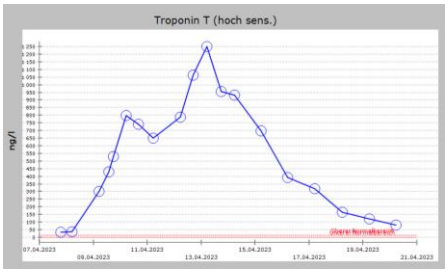
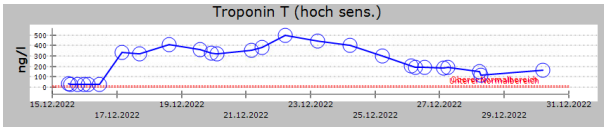
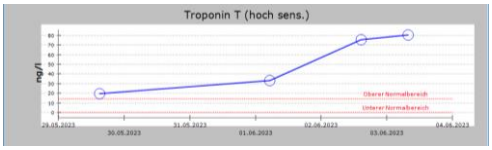
Conflicts of interest

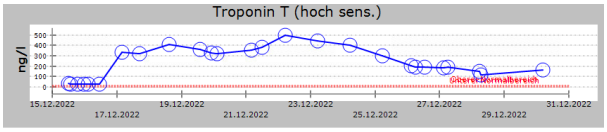
- Universitätsspital Basel, Abteilung für Kardiologie
- Roche Diagnostics

Hochsensitives kardiales Troponin T/I









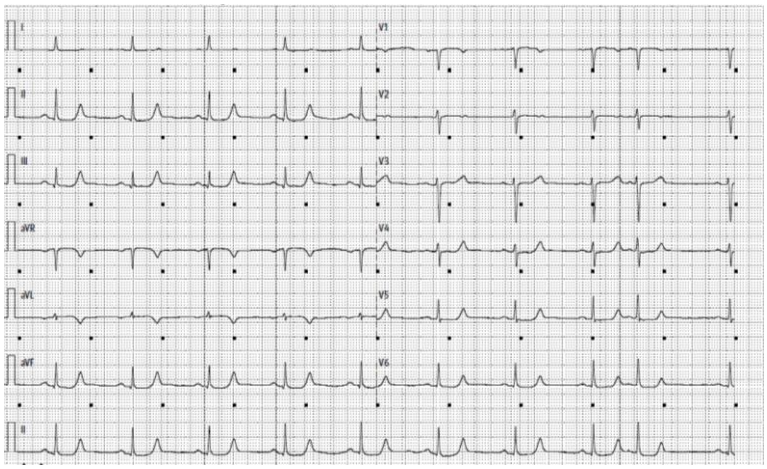
Fallbeispiel von der traumatologischen Intensivstation

74J, weiblich, Überrolltrauma UEx bds

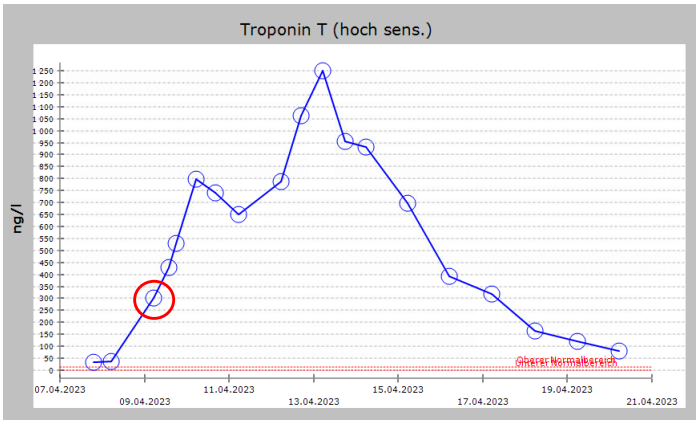
-> Notwendigkeit einer Oberschenkelamputation links + Unterschenkelamputation rechts

- <u>Vorerkrankungen</u>
  - KHK, NSTEMI 11/16 PTCA/DES LAD
  - arterielle Hypertonie, Adipositas, DM II

Präoperatives EKG



Troponindynamik



hs-cTnT Aufnahme 33 ng/L, POD1 (10h später) 38 ng/L, POD2 301 ng/L

Postoperativer Tag 2 - EKG

Weiterer Verlauf

→ **perioperativer Myokardinfarkt**

CAG:

- **LAD** prox 99% -> 0% (in-Stent-Stenose), 1x **DES**
- **LAD** med 99% -> 0%, 1x **DES**
- **LCX** prox 80% -> 0%, 1x **DES**
- RCA med 25% -> konservativ

- duale Thrombozytenaggregationshemmung T-ASS+Clopidogrel

Troponinmessung auf der Intensivstation

- nach herzchirurgischen Operationen

-> Review: Heuts et al, Cardiac troponin release following coronary artery bypass grafting: mechanisms and clinical implications. EHJ 2023

- nach Herzinfarkt/PCI
- **auf der internistischen Intensivstation**
- **nach nicht-kardialen Operationen**

Troponinerhöhung auf der Intensivstation

Kardiale Ursachen

- Plaqueruptur/Thrombus
- Koronare Vaskulitis
- Höhergradige Klappenvitien
- Myokarditis
- Akute oder chronische Herzinsuffizienz
- Kardiomyopathien
- Tachy/Bradyarrhythmien
- Defibrillation
- Aortendissektion
- Kardiale Kontusion
- Post herzchir. Eingriffen/post PCI/post Ablation

Nicht kardiale Ursachen

- Sepsis, Critical illness/Schock, Niereninsuffizienz
- Akute respiratorische Insuffizienz
- COPD, Pulmonale Hypertension
- Pulmonalembolie
- Arterielle Hypertension
- Schwere akute neurologische Erkrankungen (Schlaganfall, SAB)
- Schwere Anämie
- Schwere Verbrennungen (>30% BSA)
- Kardiotoxische Substanzen
- Extreme Anstrengung
- Lab error

Hinton et al, JICS 2020

Troponinerhöhung auf der Intensivstation
30-Tages-Mortalität

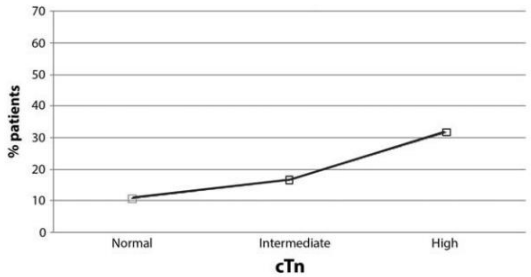
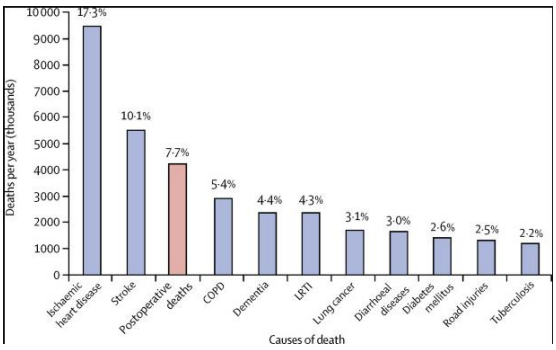
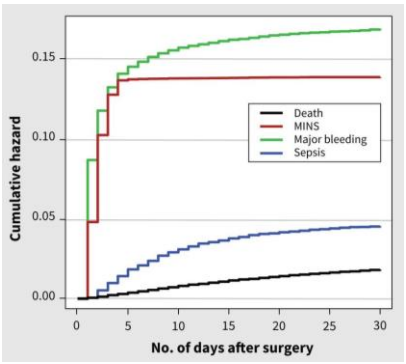


FIGURE 3. Relationship between 30-day mortality and troponin level: no cTn elevation, 10.7% 30-day mortality; intermediate cTn, 16.6% 30-day mortality; high cTn, 31.7% 30-day mortality.

Poe et al, J Investig Med 2015

Postoperative Mortalität & Komplikationen

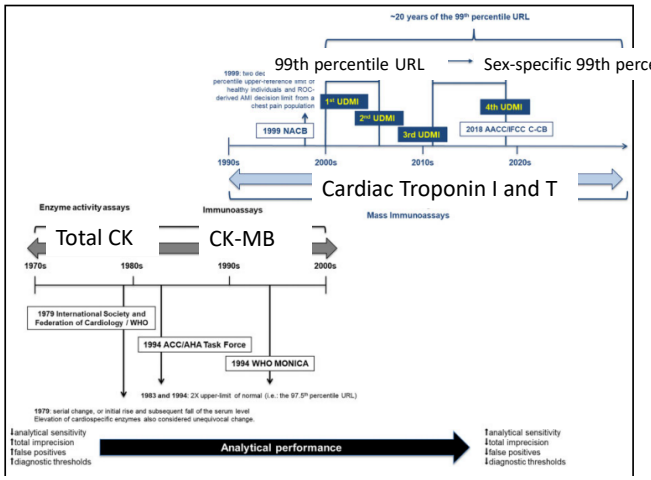




PMI = MINS
MINS = myocardial injury after non-cardiac surgery
PMI = perioperative myocardial injury/infarction

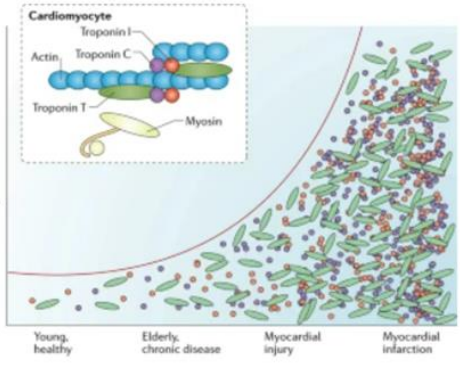
Nepogodiev et al, Lancet 2019
Spence et al, CMAJ 2019

Kardiale Biomarker - Assay timeline



Sandoval et al, Clin Chem 2020

hochsensitive kardiale Troponine



cTnI >> cTnT herzspezifisch

Thygesen et al, EHJ 2018

Perioperativer Myokardschaden/-infarkt

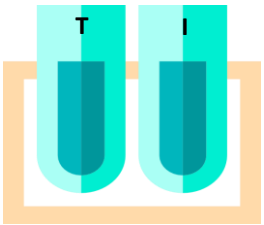
–

Wie erkennen?

vs.

Akuter Myokardinfarkt

- Kardiale Troponine erhöht (mind. 1 Wert > 99. Perzentile) + Dynamik (Anstieg/Abfall)
- PLUS ≥1 zusätzliches Kriterium:
  - Klinische Symptome einer Myokardischämie
  - EKG Veränderungen
  - Neue Wandbewegungsstörungen
  - (Nachweis eines thrombotischen Verschlusses)



PLUS

ODER

Thygesen et al, 2018 EHJ

Perioperativer Myokardschaden/-infarkt

- Symptome und EKG inkonsistent

Table 2. Ischemic Features of Patients Suffering Myocardial Injury after Noncardiac Surgery

	Prevalence		Mortality at 30 days	
Ischemic Feature*	n	% (95% CI)	n	% (95% CI)
Ischemic symptoms				
Chest discomfort	85	9.0 (7.4–11.0)	17	20.0 (12.9–29.7)
Neck, jaw, or arm discomfort	5	0.5 (0.2–1.2)	0	0.0 (0.0–43.4)
Dyspnea	66	7.0 (5.6–8.8)	10	15.2 (8.4–25.7)
Pulmonary edema	46	4.9 (3.7–6.5)	[illegible]	17.4 (9.1–30.7)
Any of the above	149	15.8 (13.6–18.3)		14.8 (10.0–21.3)
Ischemic electrocardiographic findings				
Q waves	13	1.4 (0.8–2.3)	1	7.7 (1.4–33.3)
ST elevation	22	2.3 (1.5–3.5)	7	31.8 (16.4–52.7)
LBBB	5	0.5 (0.2–1.2)	3	60.0 (23.1–88.2)
ST depression	154	16.4 (14.1–18.9)	21	13.6 (9.1–19.9)
T-wave inversion	219	23.3 (20.7–26.1)	[illegible]	14.2 (10.2–19.4)
Any of the above	328	34.9 (31.9–38.0)		14.3 (10.9–18.5)

15.8 (13.6–18.3)

34.9 (31.9–38.0)

Medizinische Universität Innsbruck

Botto et al, 2014 Anaesthesiology
Puelacher et al, 2018 Circulation

Hillinger, IFIMP 2024

Perioperativer Myokardschaden/-infarkt

- Symptome und EKG inkonsistent → **hs-cTnT!!!**

Table 2. Ischemic Features of Patients Suffering Myocardial Injury after N

	Prevalence	
Ischemic Feature*	n	% (95%
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Chest discomfort	85	9.0 (7.4–1
Neck, jaw, or arm discomfort	5	0.5 (0.2–1
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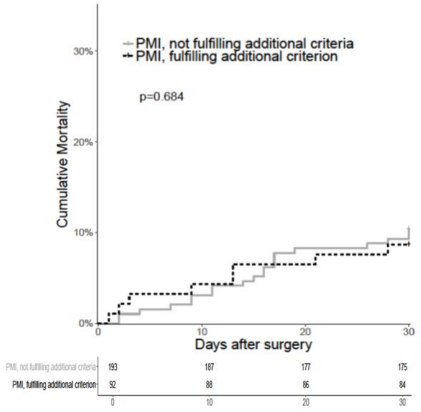

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Hillinger, IFIMP 2024

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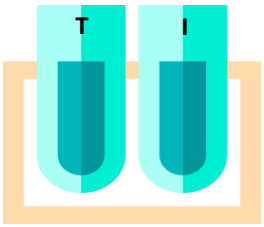
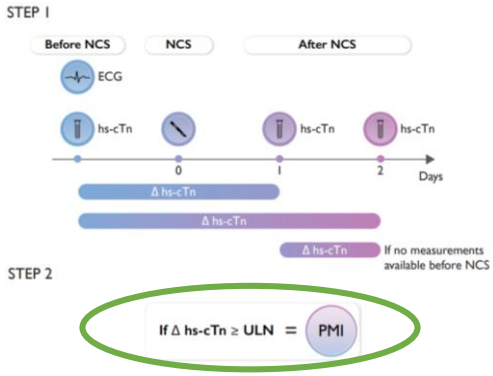




Thygesen et al, 2018 EHJ
Halvorsen et al, EHJ 2022

Rationale for PMI-definition: cutoff

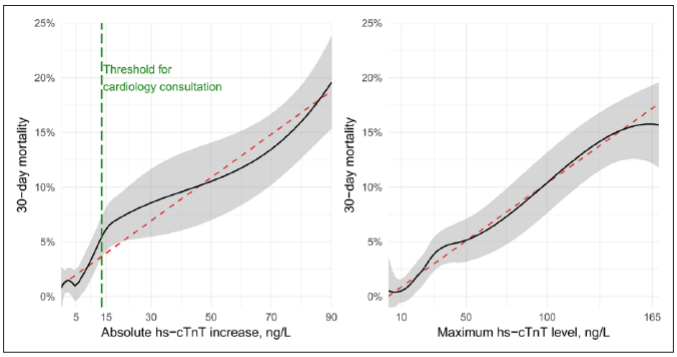
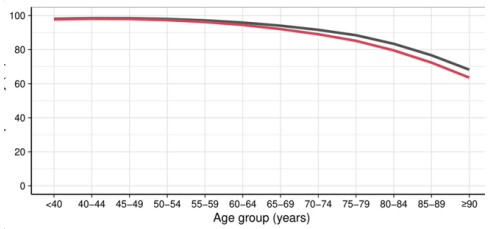


Figure 3. Cardiac troponin and mortality.
Association of absolute high-sensitivity cardiac troponin T (hs-cTnT) increase and maximum postoperative hs-cTnT level with 30-day mortality (black continuous line with 95% confidence intervals in gray). A general linear fit is shown as red dashed line. Because the association of absolute hs-cTnT increases with 30-day mortality might be affected by identifying and flagging patients with perioperative myocardial injury in clinical routine at hs-cTnT deltas of ≥14 ng/L, this threshold was highlighted in the plot of absolute hs-cTnT increase (green dashed line).

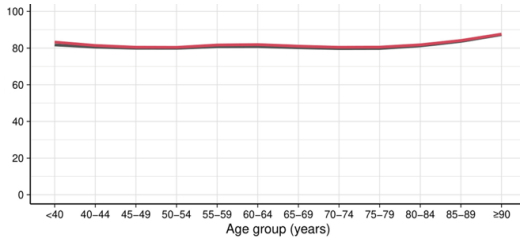
Puelacher et al, 2018 Circulation

Troponin und Alter

Spezifität



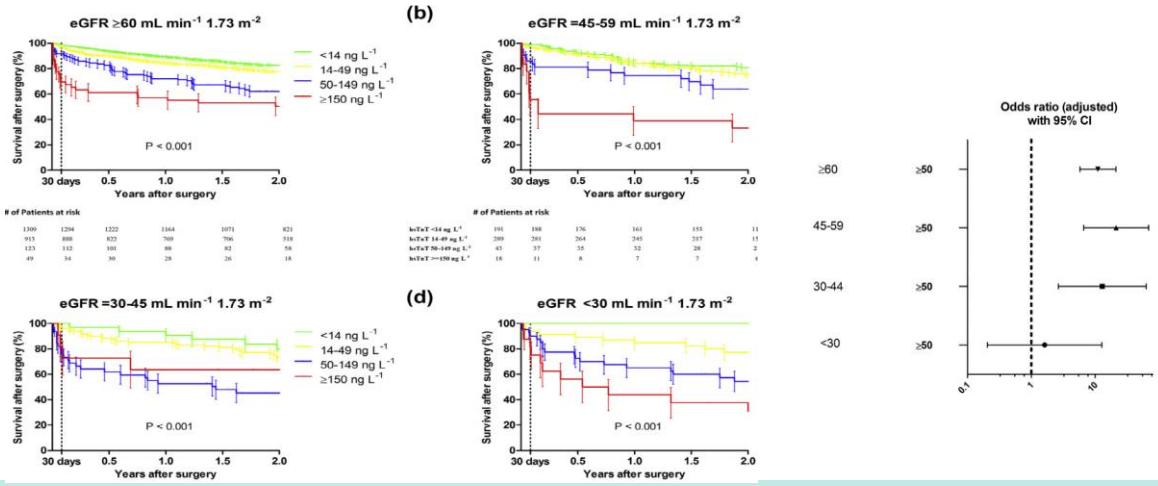
Sensitivität



Myocardial infarction — Type 1 myocardial infarction

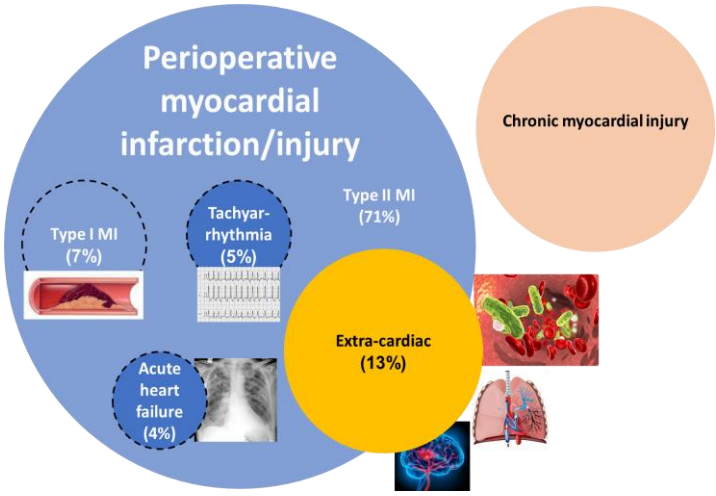
Lowry et al, Circulation 2022

Troponin und Niere



Liem et al, BJA 2018

PMI Ätiologie – sehr heterogen



Adaptiert von Puelacher et al, JACC 2020

……in unterschiedlichen chirurgischen Disziplinen

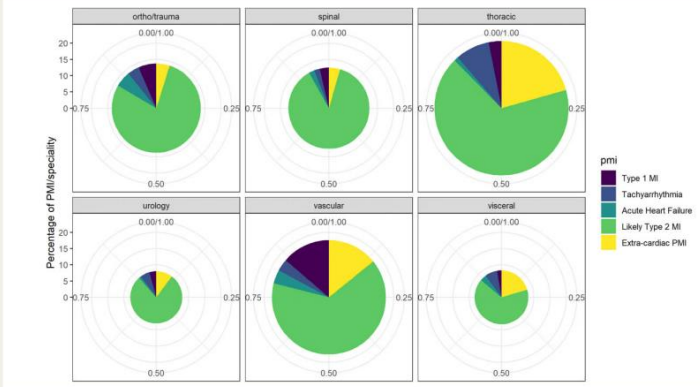
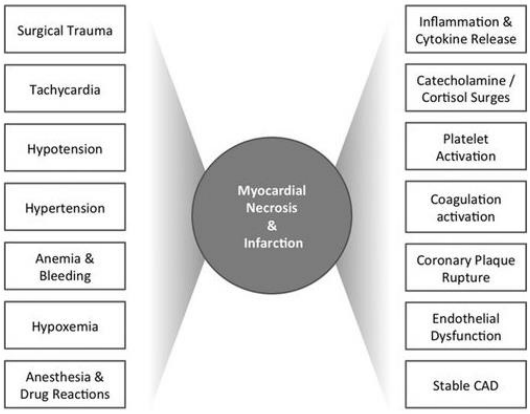


Figure 2 Distribution of adjudicated aetiology of perioperative myocardial infarction/injury in different surgical specialities. The size of the circle indicates the overall percentage of perioperative myocardial infarction/injury, and the different colours indicate the adjudicated aetiologies of perioperative myocardial infarction/injury following surgery in the respective specialities.

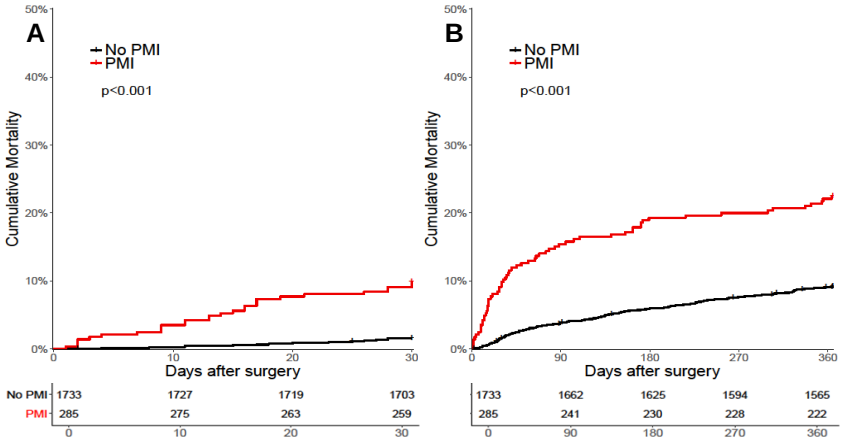
Puelacher et al, EHJ 2022

PMI -Ursachen



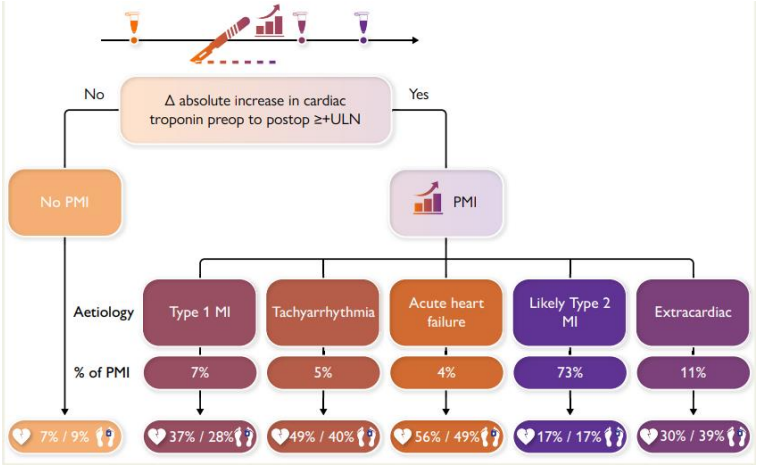
Smilowitz et al, Circulation 2016

PMI -> schlechte Langzeitprognose



Puelacher et al, 2018 Circulation

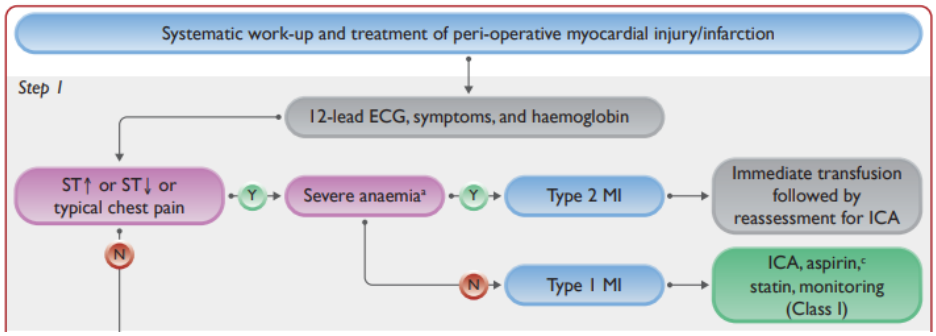
PMI : 1-Jahres-Mortalität



Puelacher et al, EHJ 2022

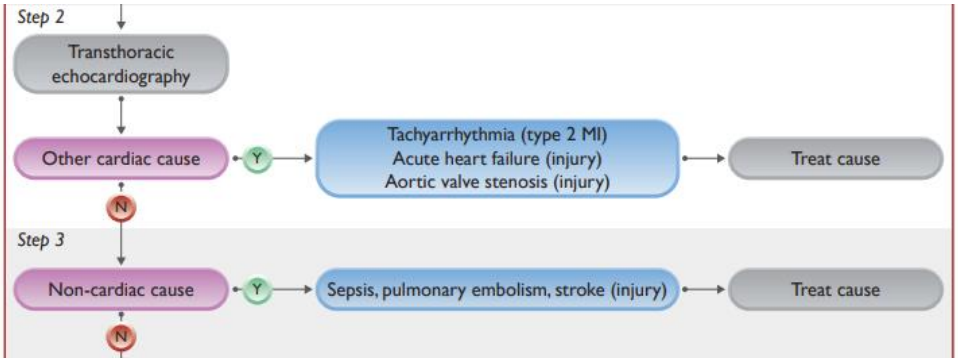
PMI - Wie behandeln?

Systematic work-up



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

Systematic work-up



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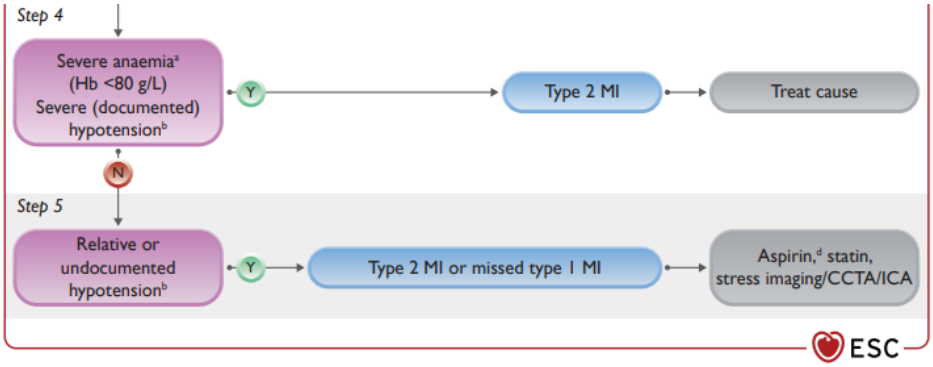


2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery, EHJ 2022

Management of PMI

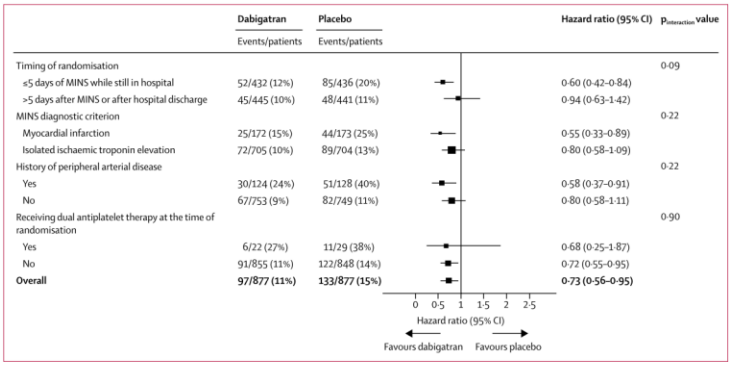
- Observationsstudien:
  - Beginn Statintherapie
  - Erwäge ASS je nach Blutungsrisiko
  - Definition der Ätiologie → Behandlung nach entsprechender Guideline aus nicht-chirurg. Setting

- Randomised controlled trial – MANAGE
  - Consider dabigatran according to bleeding risk

In patients with MINS and at low risk of bleeding, treatment with dabigatran 110 mg orally *b.i.d.* may be considered from ~1 week after NCS.[650]	IIb	B

Devereaux et al, The Lancet 2018
Devereaux et al, Annals of Int Med 2011
Foucrier et al, Anaesth and Analg 2014
Puelacher et al, JACC 2020

MANAGE results - subgroups



	Dabigatran Events/patients	Placebo Events/patients	Hazard ratio (95% CI)	$p_{interaction}$ value
Timing of randomisation				0·09
≤5 days of MINS while still in hospital	52/432 (12%)	85/436 (20%)	0·60 (0·42–0·84)	
>5 days after MINS or after hospital discharge	45/445 (10%)	48/441 (11%)	0·94 (0·63–1·42)	
MINS diagnostic criterion				0·22
Myocardial infarction	25/172 (15%)	44/173 (25%)	0·55 (0·33–0·89)	
Isolated ischaemic troponin elevation	72/705 (10%)	89/704 (13%)	0·80 (0·58–1·09)	
History of peripheral arterial disease				0·22
Yes	30/124 (24%)	51/128 (40%)	0·58 (0·37–0·91)	
No	67/753 (9%)	82/749 (11%)	0·80 (0·58–1·11)	
Receiving dual antiplatelet therapy at the time of randomisation				0·90
Yes	6/22 (27%)	11/29 (38%)	0·68 (0·25–1·87)	
No	91/855 (11%)	122/848 (14%)	0·72 (0·55–0·95)	
Overall	**97/877 (11%)**	**133/877 (15%)**	**0·73 (0·56–0·95)**	

Figure 3: **Subgroup analyses of the primary efficacy outcome**

Zusammenfassung
Troponin auf der ICU/IMCU

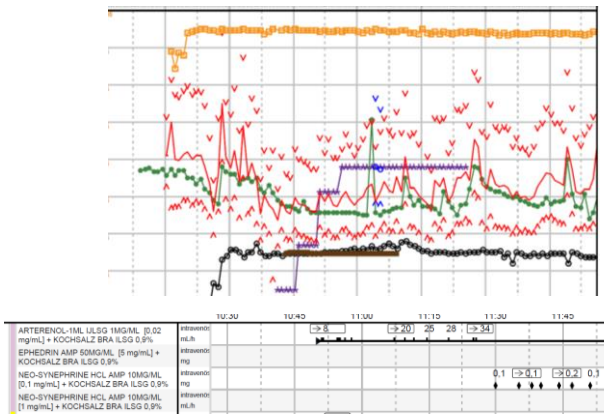
- Erhöhte Troponinwerte **sehr häufig!**
  → Korrelation mit **Mortalität** und **kardiovaskulären Ereignissen**!
- Ursachen **heterogen**
- **Perioperativer Myokardschaden/-infarkt = häufige** Komplikation nach nicht-herzchirurgischen Operationen
- optimales Management?

Femoralisgabelplastik bei pAVK

- **männlich, 76J**
- **Vorerkrankungen**
- mehrfache Voroperationen iR pAVK
- COPD II
- Subclavian-Steal-Syndrom Grad III links
- AVB I°, RSB, arterielle Hypertonie
- Nierenarterienstenose links, CNI

Keine AP, keine Dyspnoe

Nach Narkoseeinleitung…



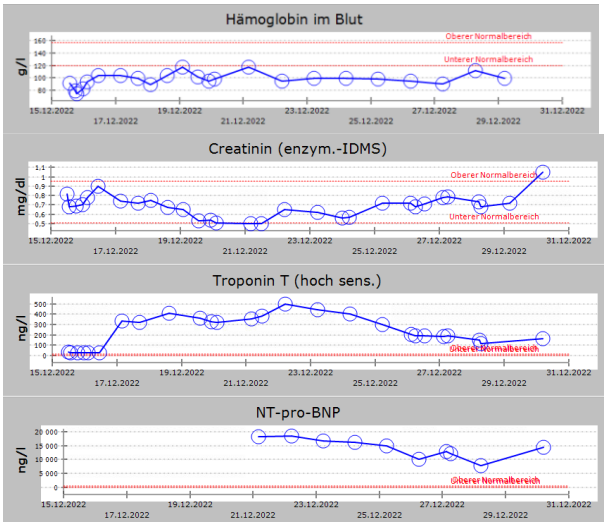
Komplizierter perioperativer Verlauf

- Nach AN Einleitung hoher Katecholaminbedarf + neu aufgetretene ST Senkungen inferior (II, III) -> TEE: ausgeprägte LVH, **mittelgradige Aortenstenose**, erhaltene LVF, leichte Hypokinesie inferoseptal, kein Perikarderguss.
- Intraoperative ZVK Anlage (erschwert) mit Hämatom Hals
  - Hämatomausräumung durch HNO am 1.POD

Relevanter Troponinanstieg am 2.POD -> **PMI**

RS Kardiologie: kein akuter Handlungsbedarf, Fortführen ASS + Heparin sobald vertretbar

Labor



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Hillinger, IFIMP 2024