

LUCCA MEETING · LUZERN · APRIL 2026

Impella for all anterior STEMIs?

Contemporary shock management with mechanical circulatory support devices

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Cardiology · HFR Fribourg

Friday session · 11:05 – 11:25

Disclosures

No conflicts of interest to declare

A familiar Frida night

51-year-old · chest pain 90 min · anterior STEMI

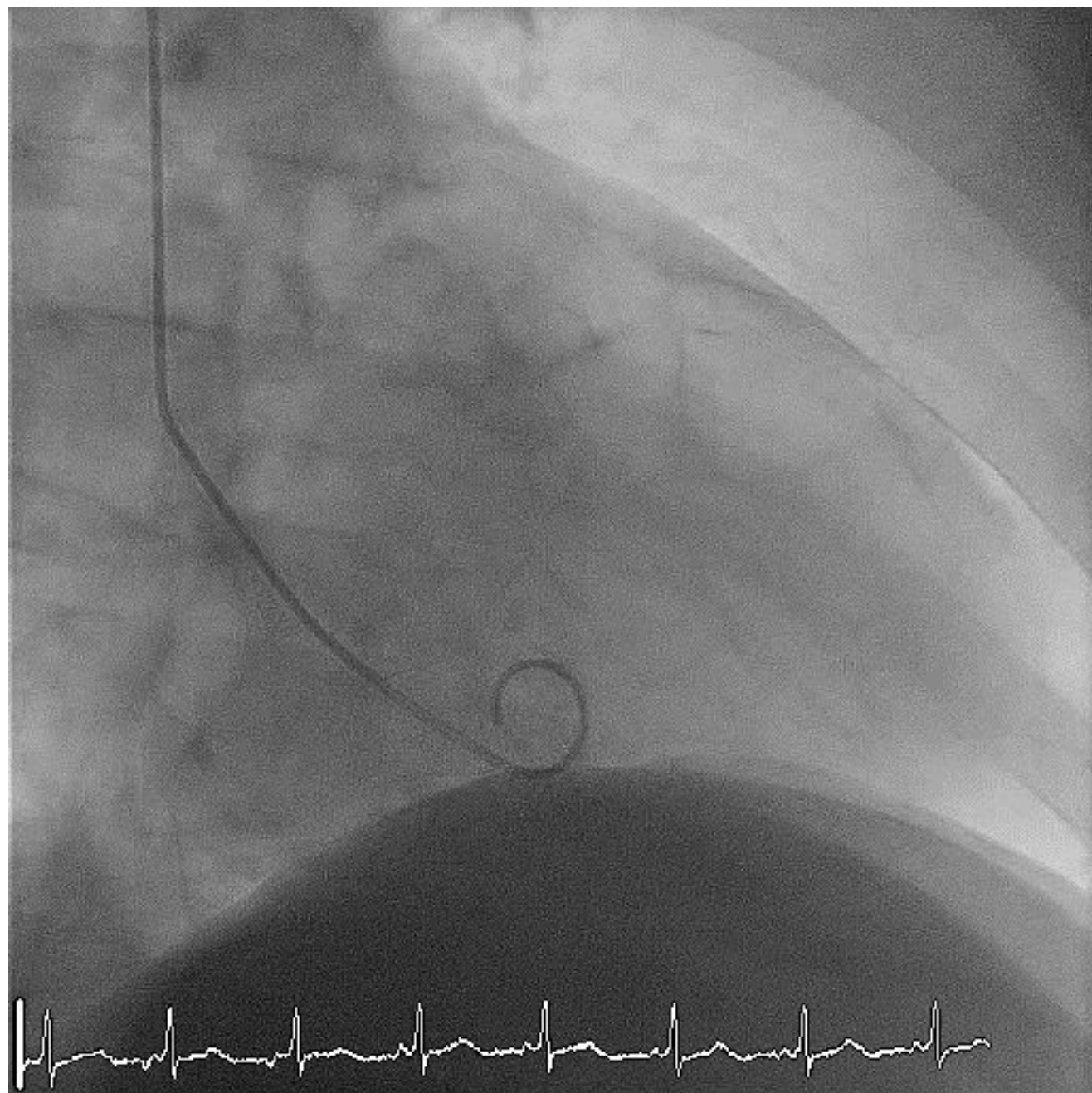
At the cath-lab door

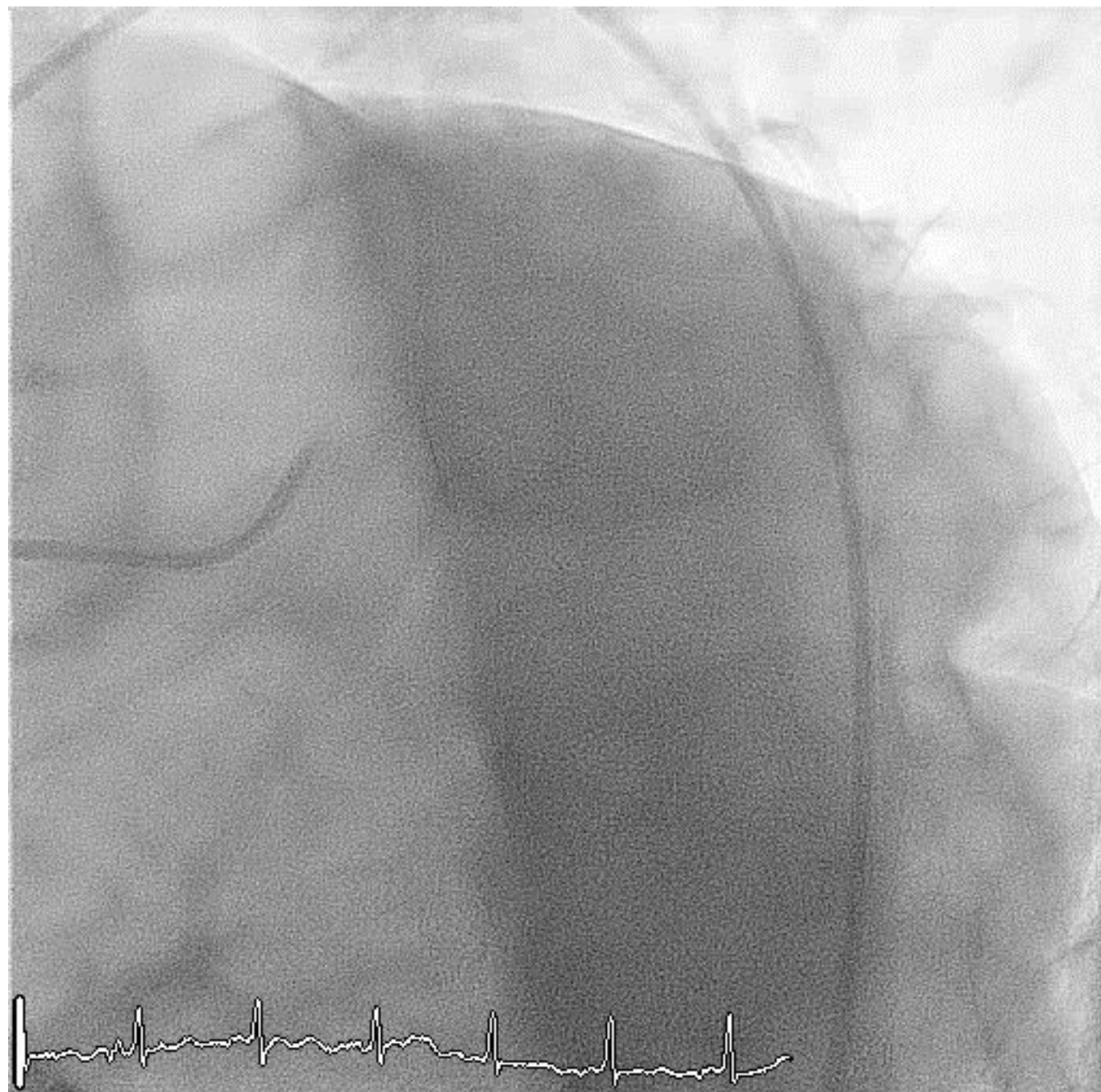
BP	85 / 55 mmHg
HR	95 bpm · sinus
ECG	ST ↑ V1–V5, aVL
Lactate	2.8 mmol/L
SpO ₂	91 % on 4 L O ₂
Echo	LVEF ~ 25 %, akinetic apex
TIMI	0 flow in proximal LAD

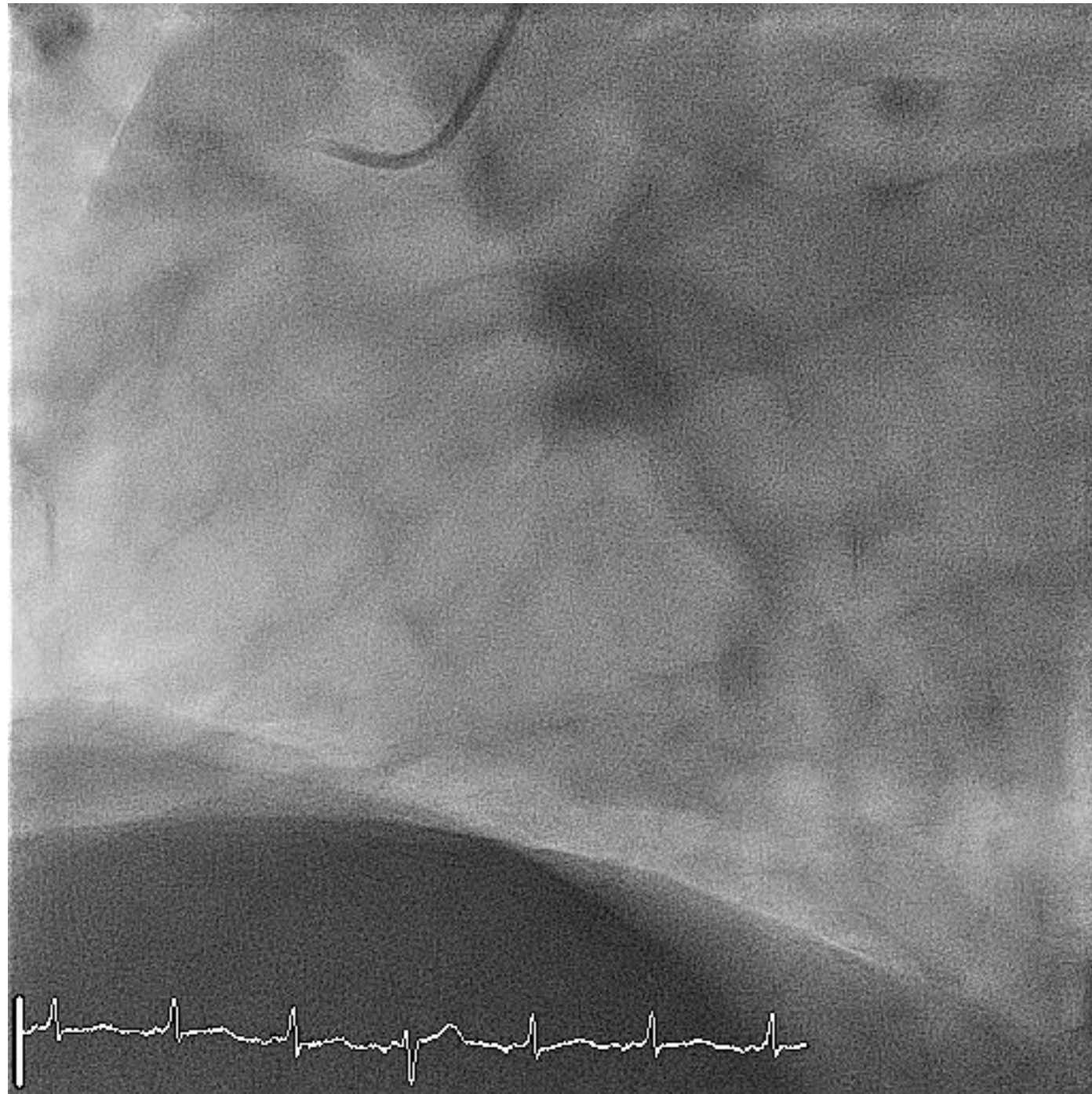
Today's question

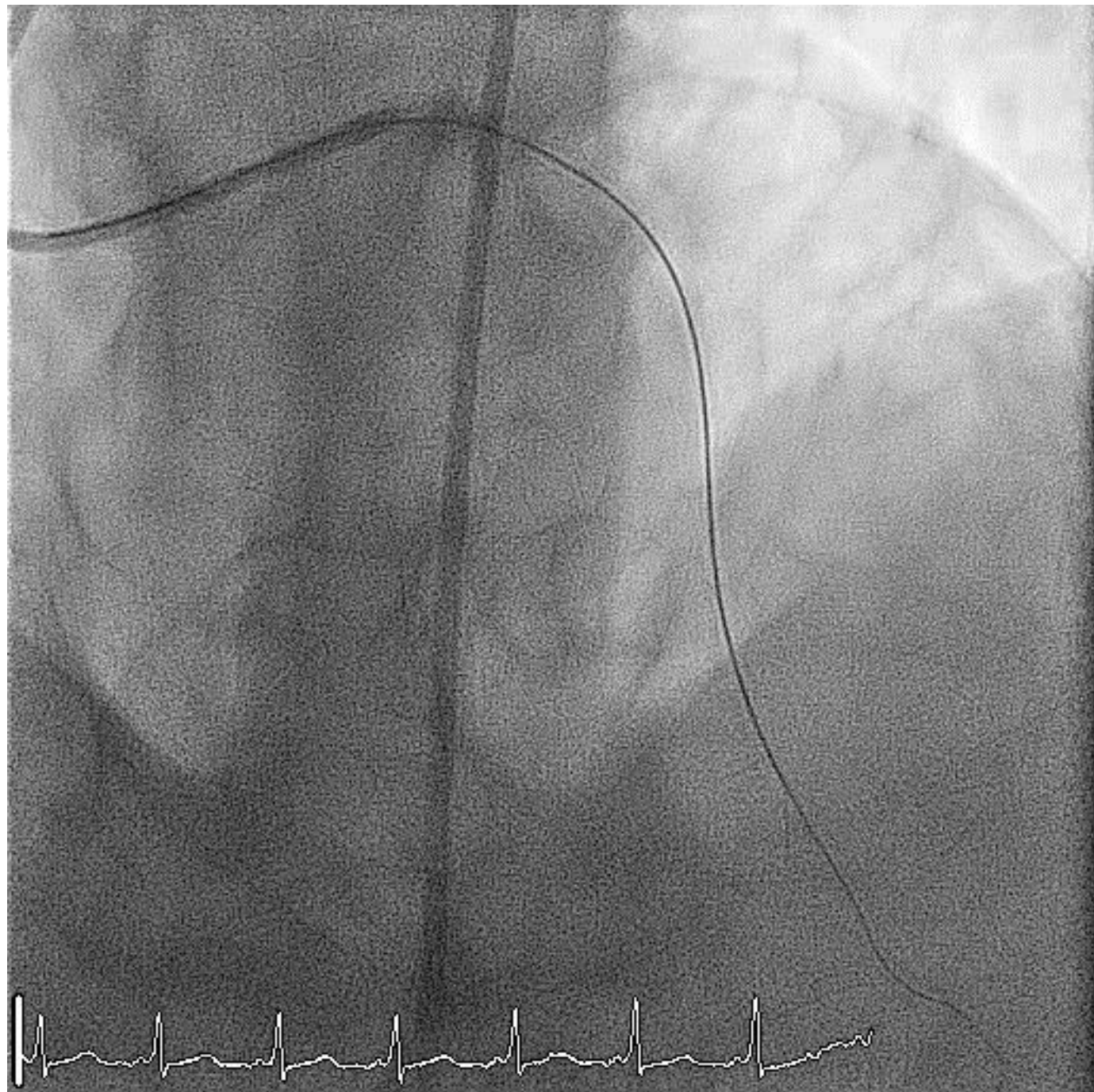
Impella for *all* anterior STEMIs?

1. Which patient truly benefits?
2. Which device — IABP, Impella CP, VA-ECMO?
3. When to deploy — before or after PCI?
4. How to avoid the bleeding / ischaemia trap?

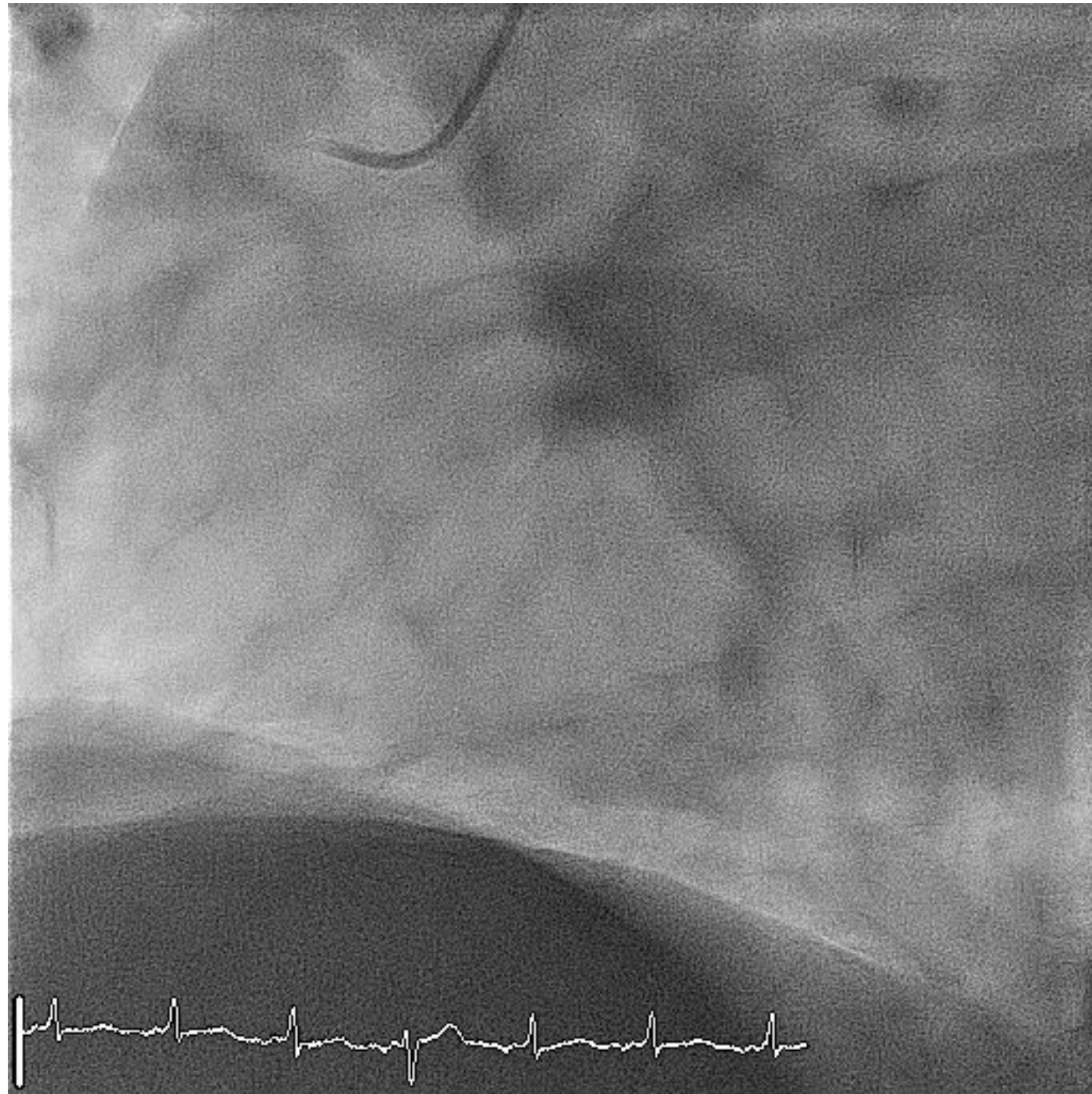


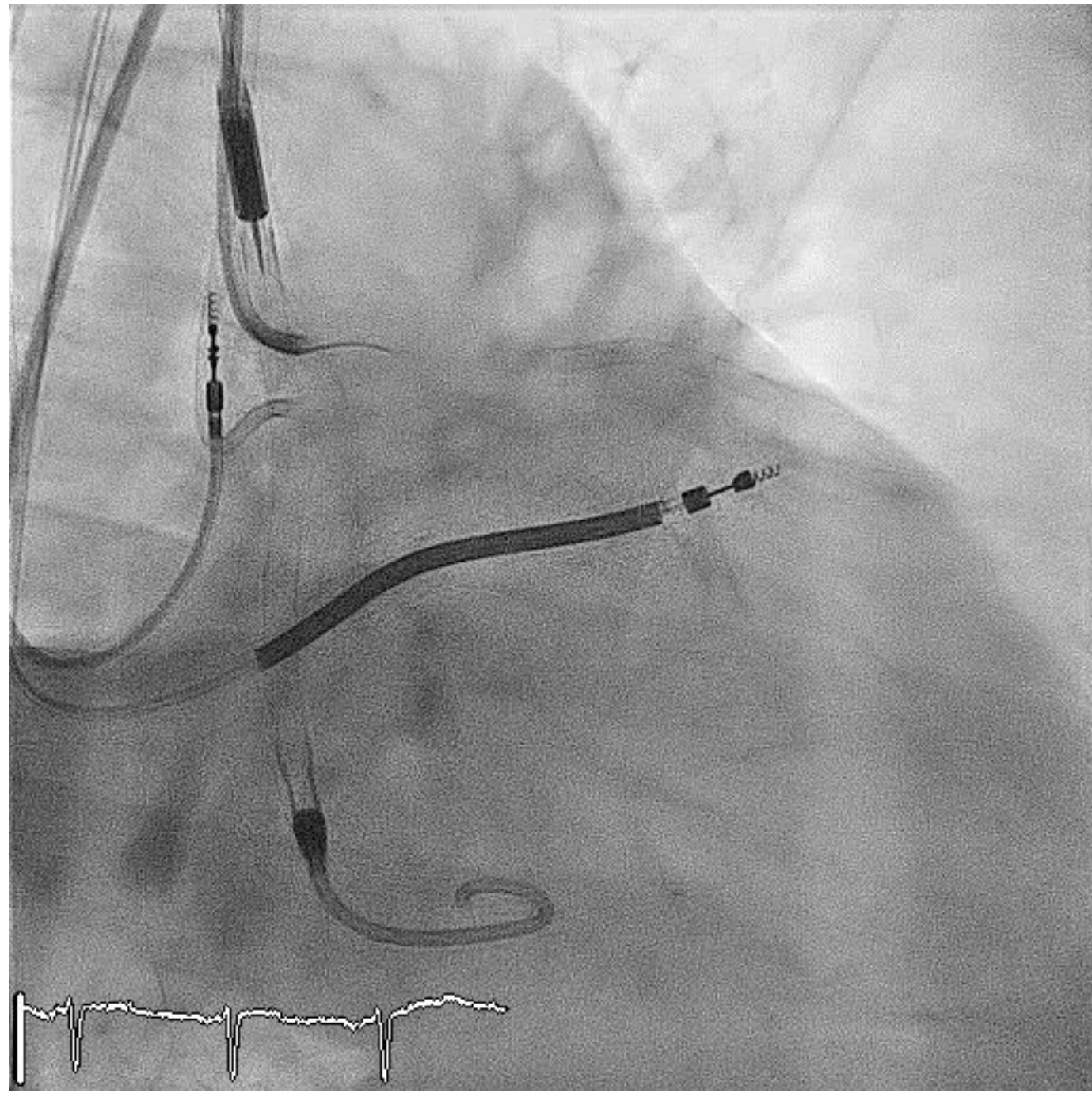


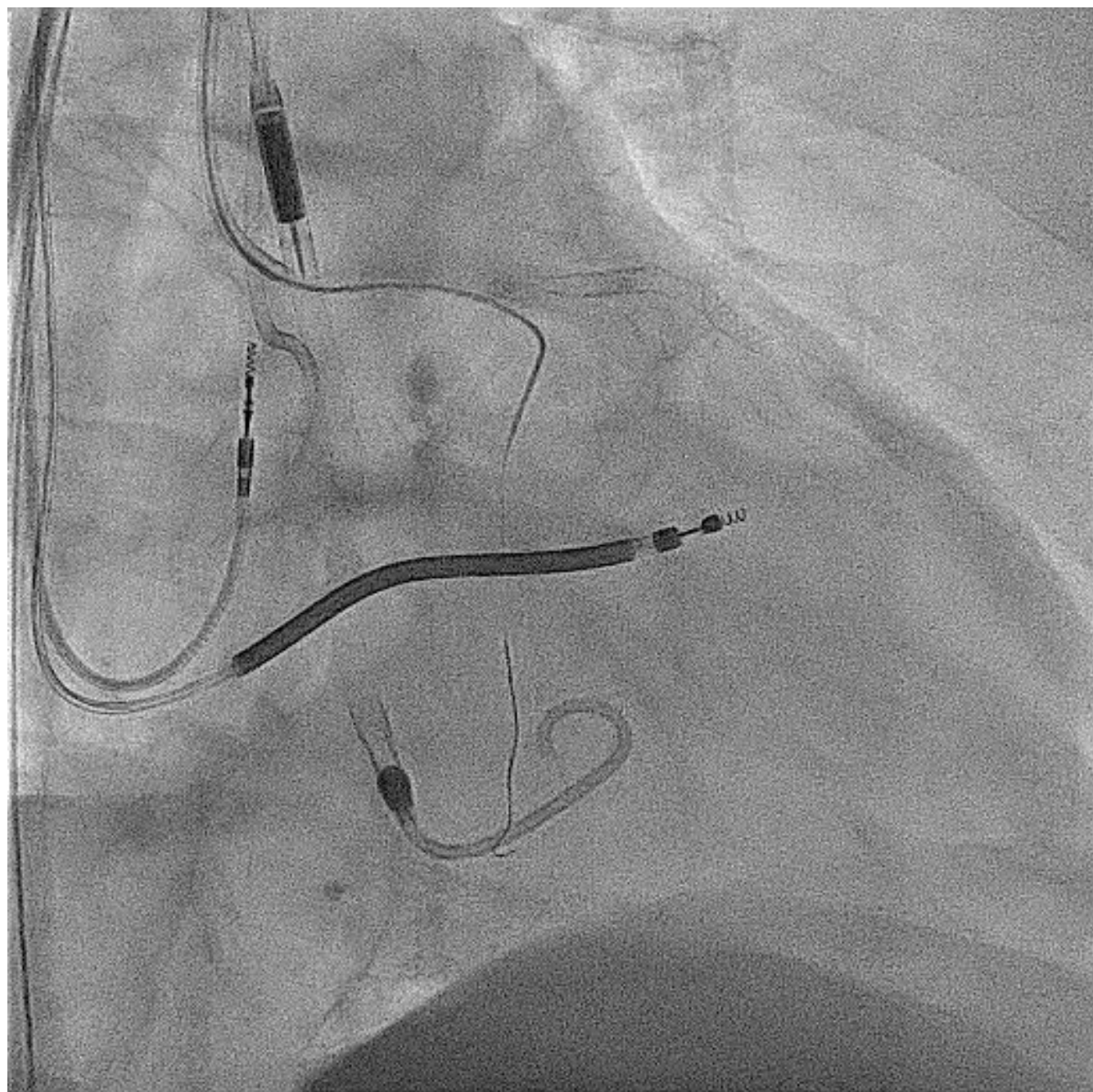


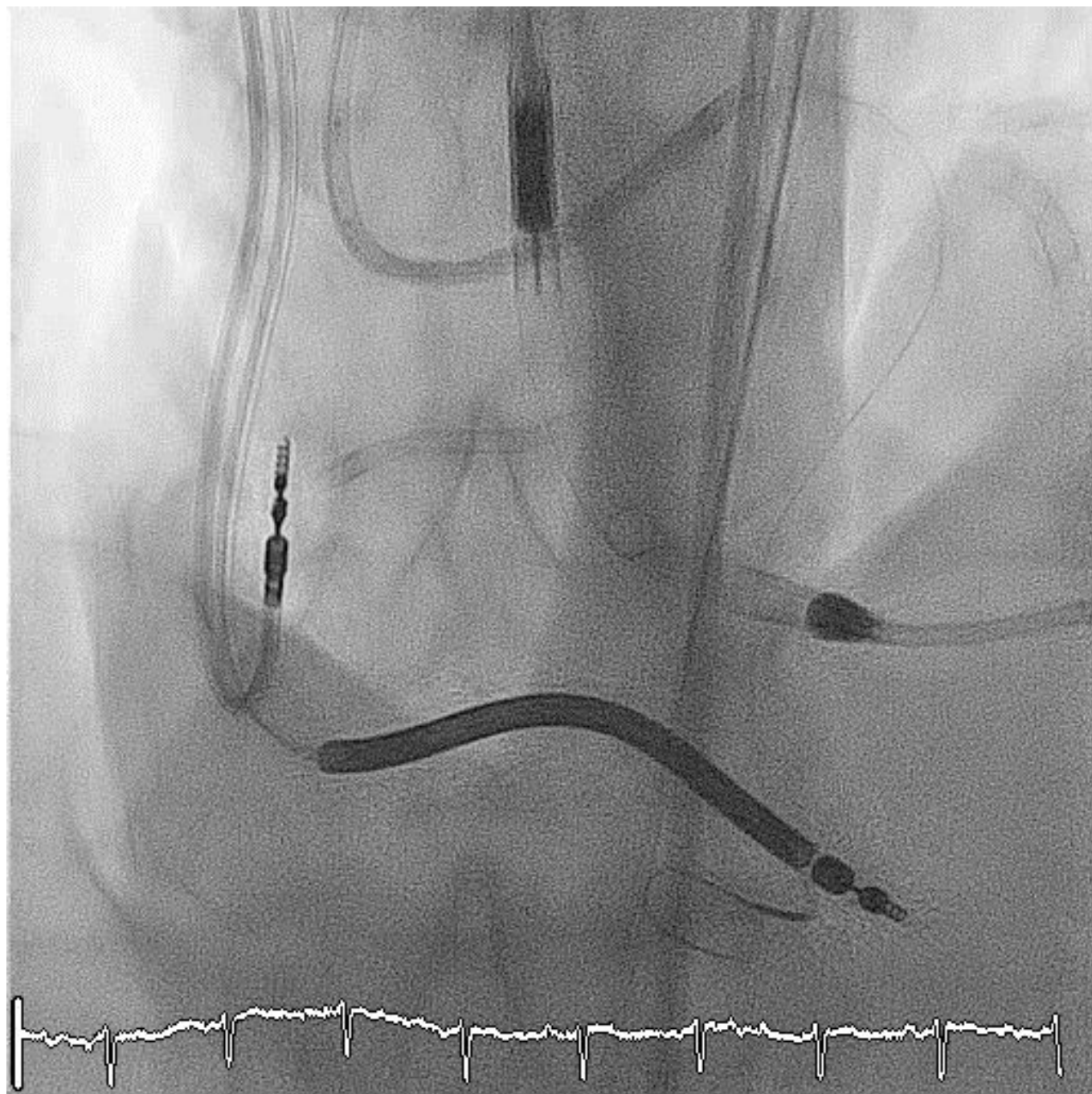


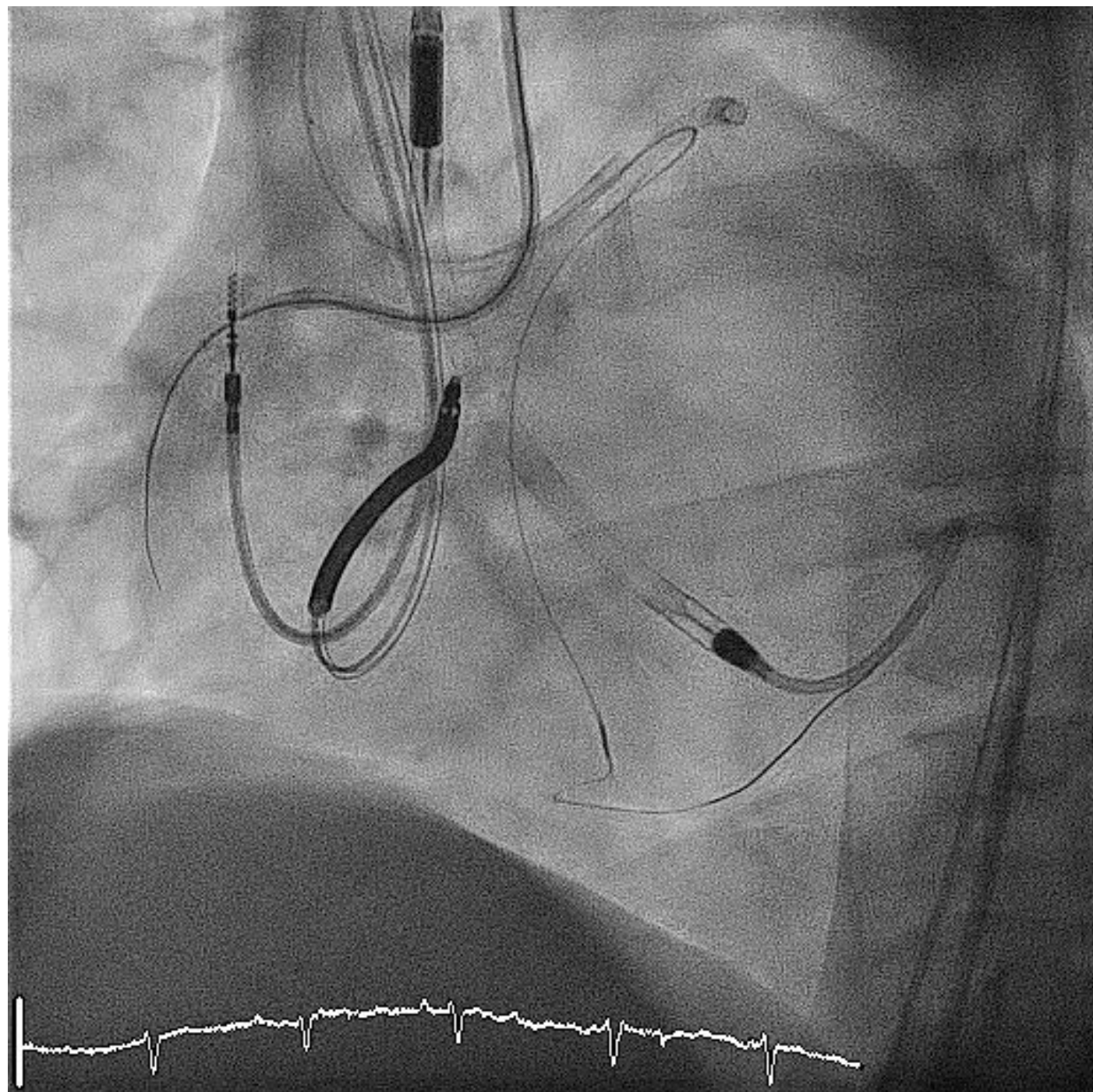


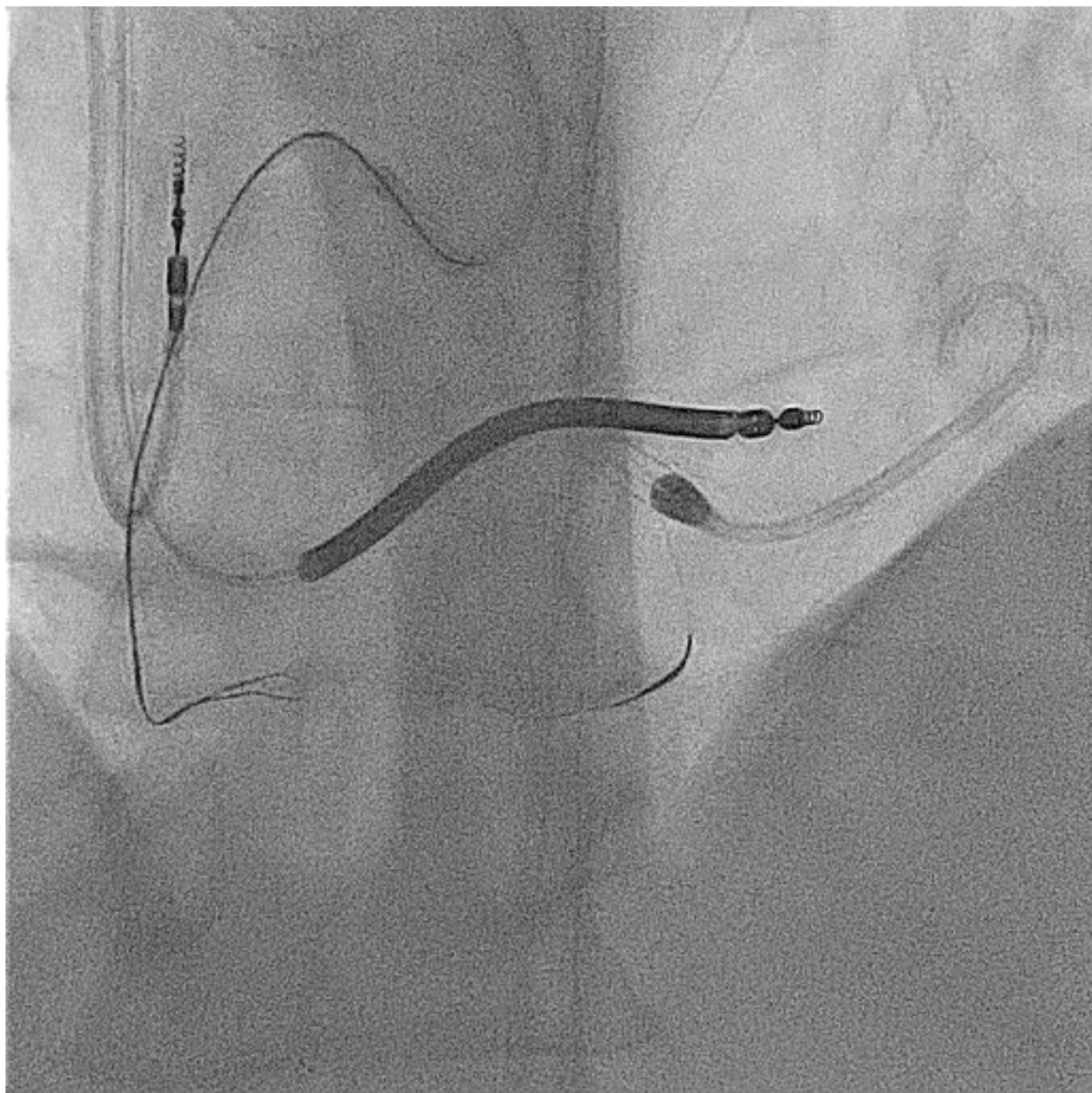


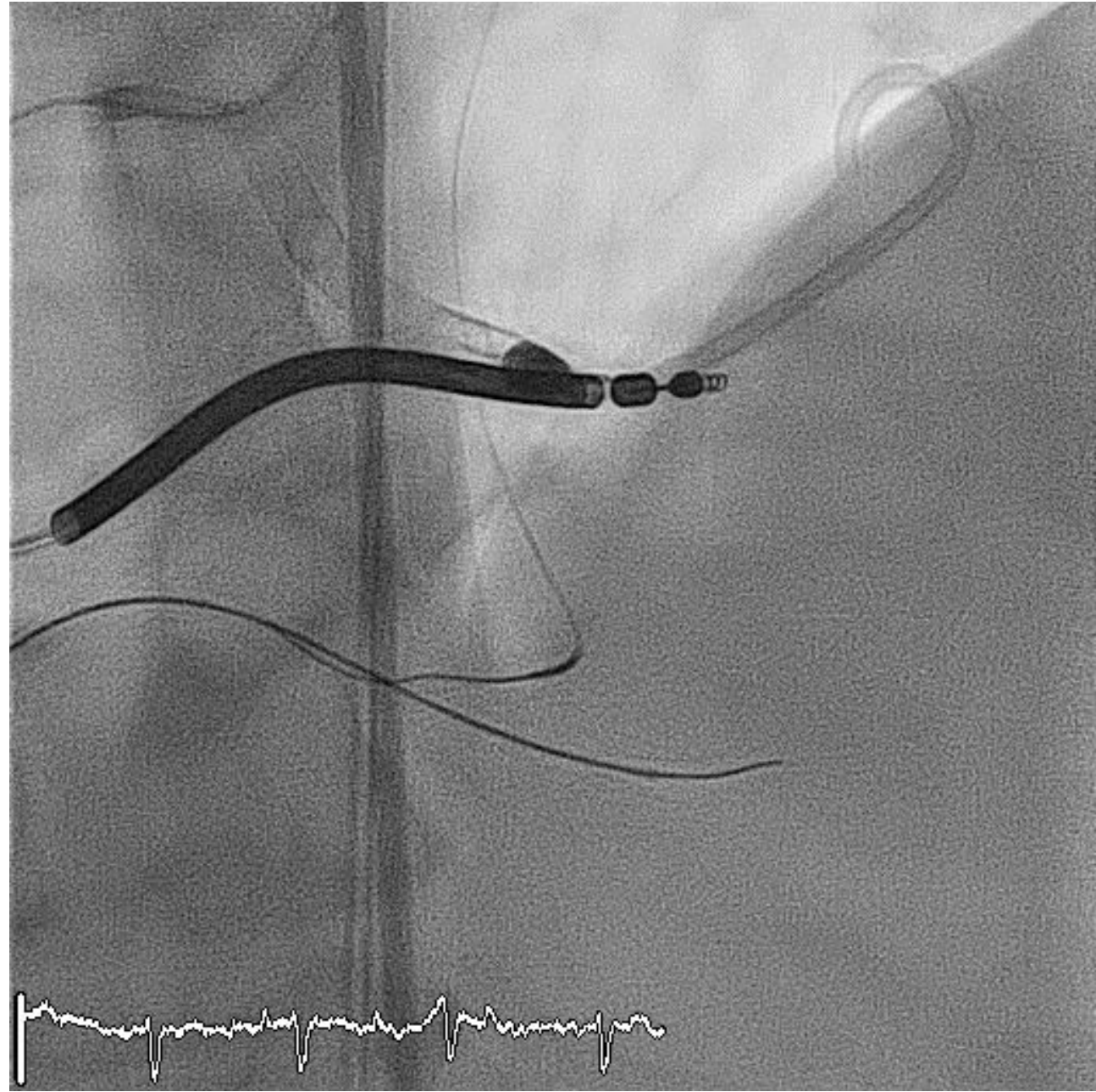


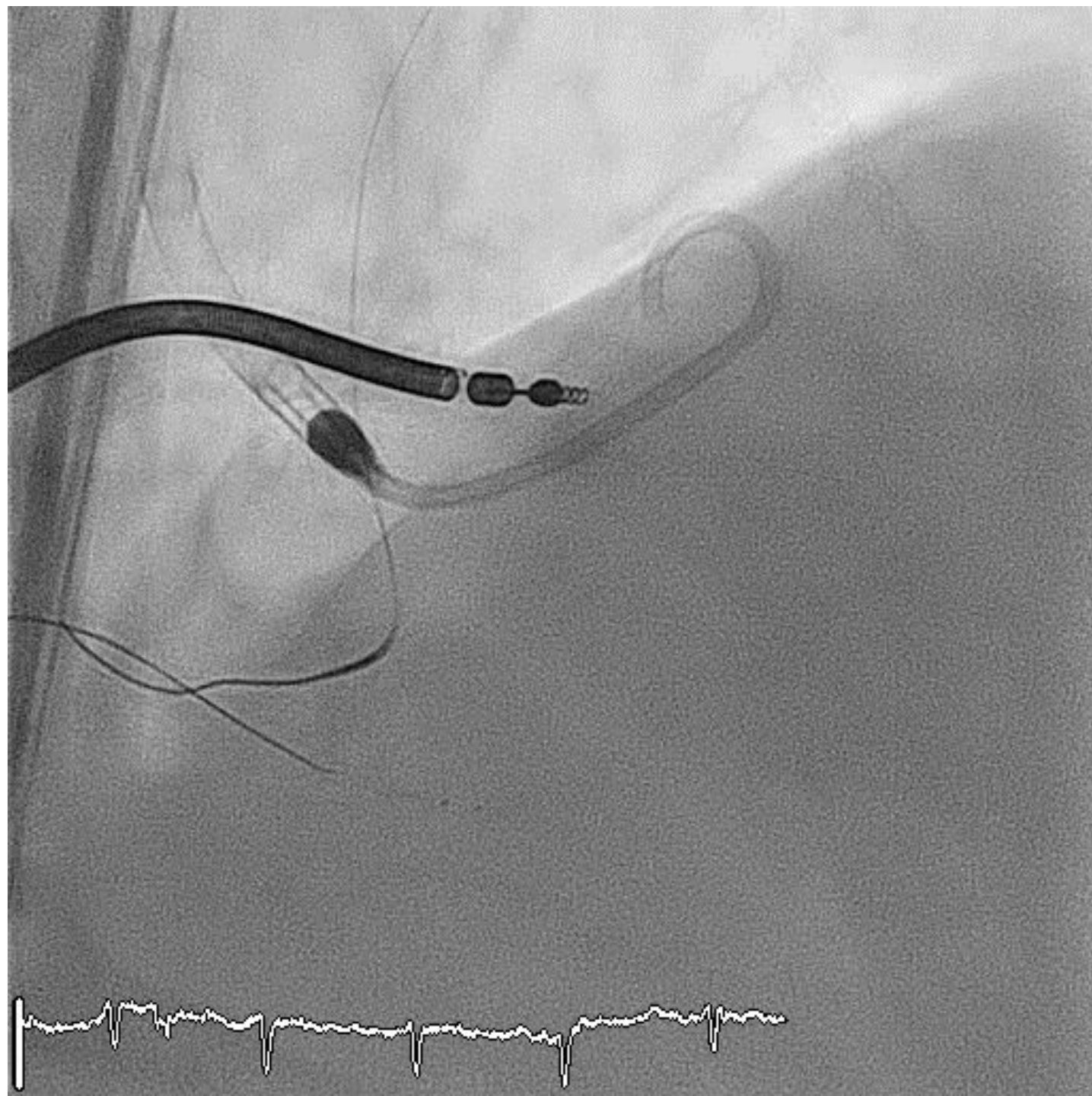


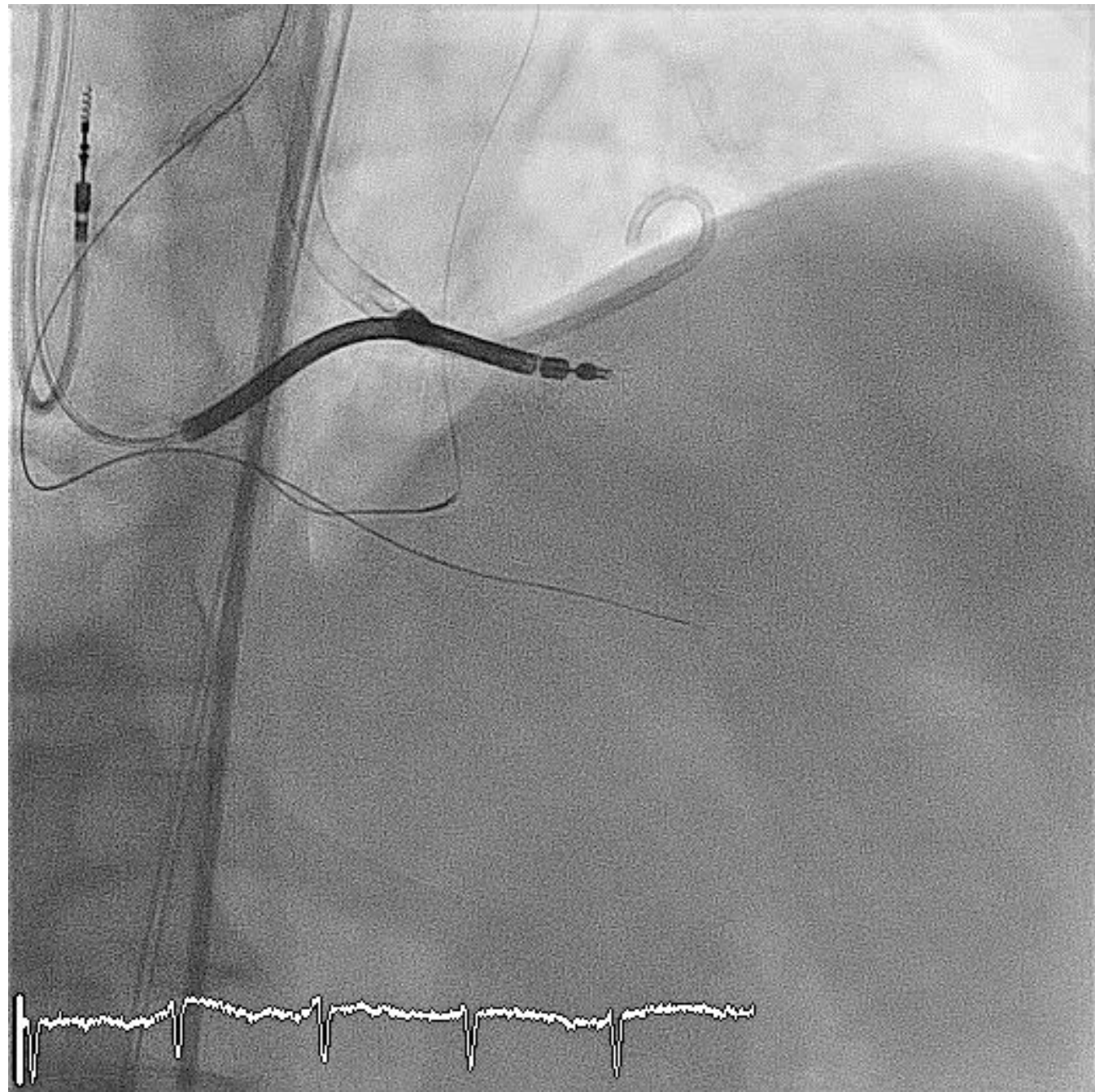


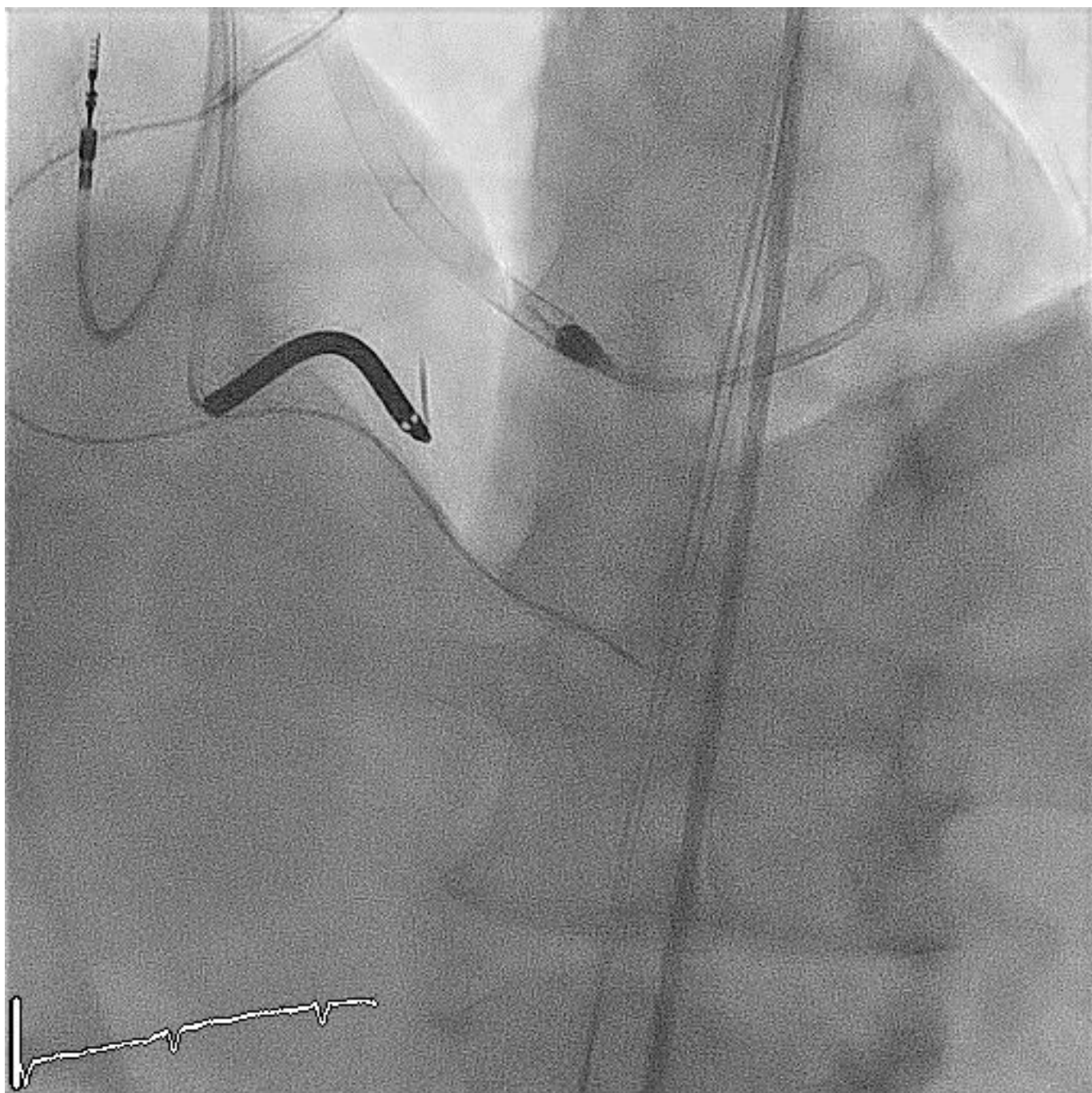


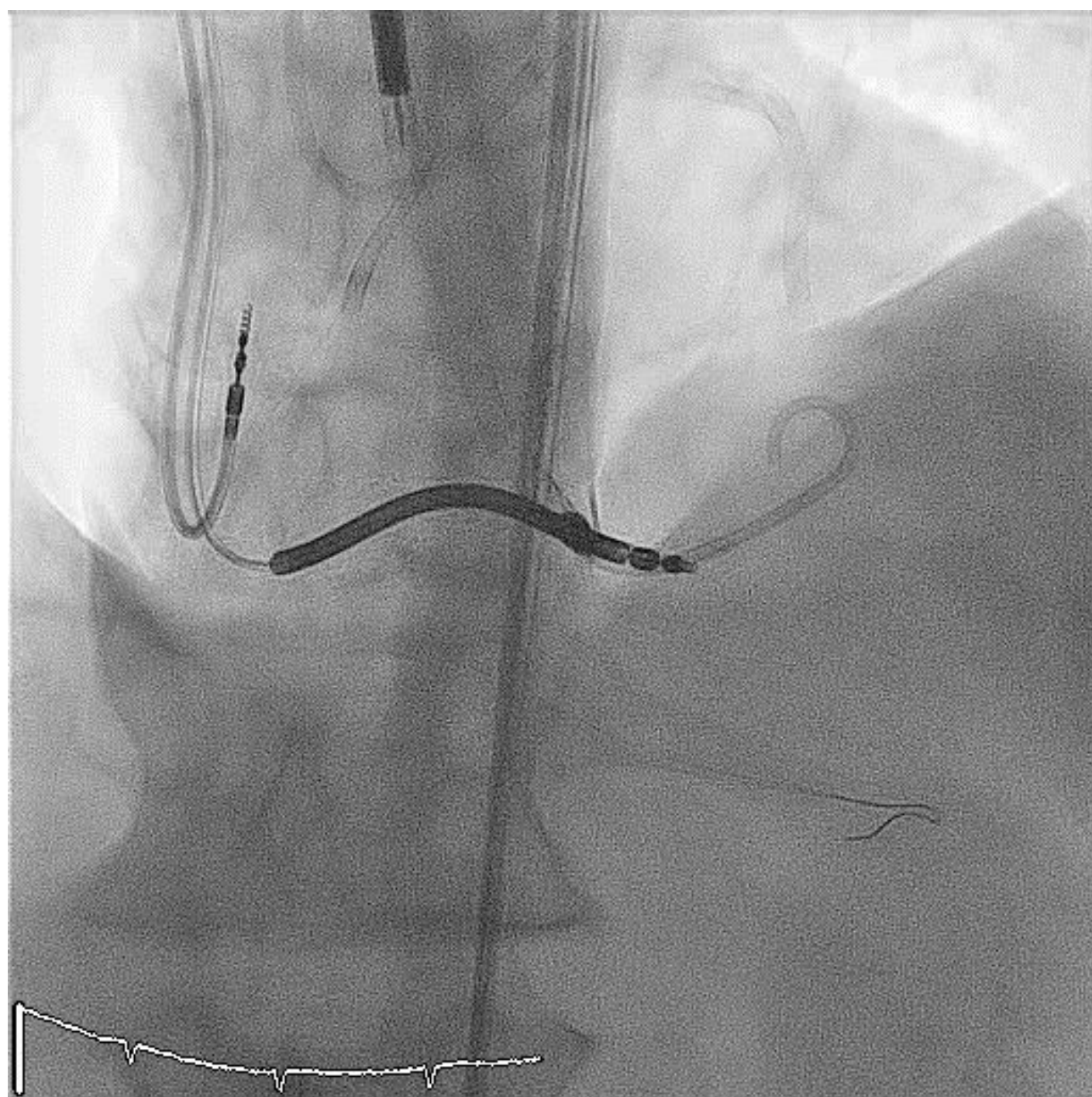


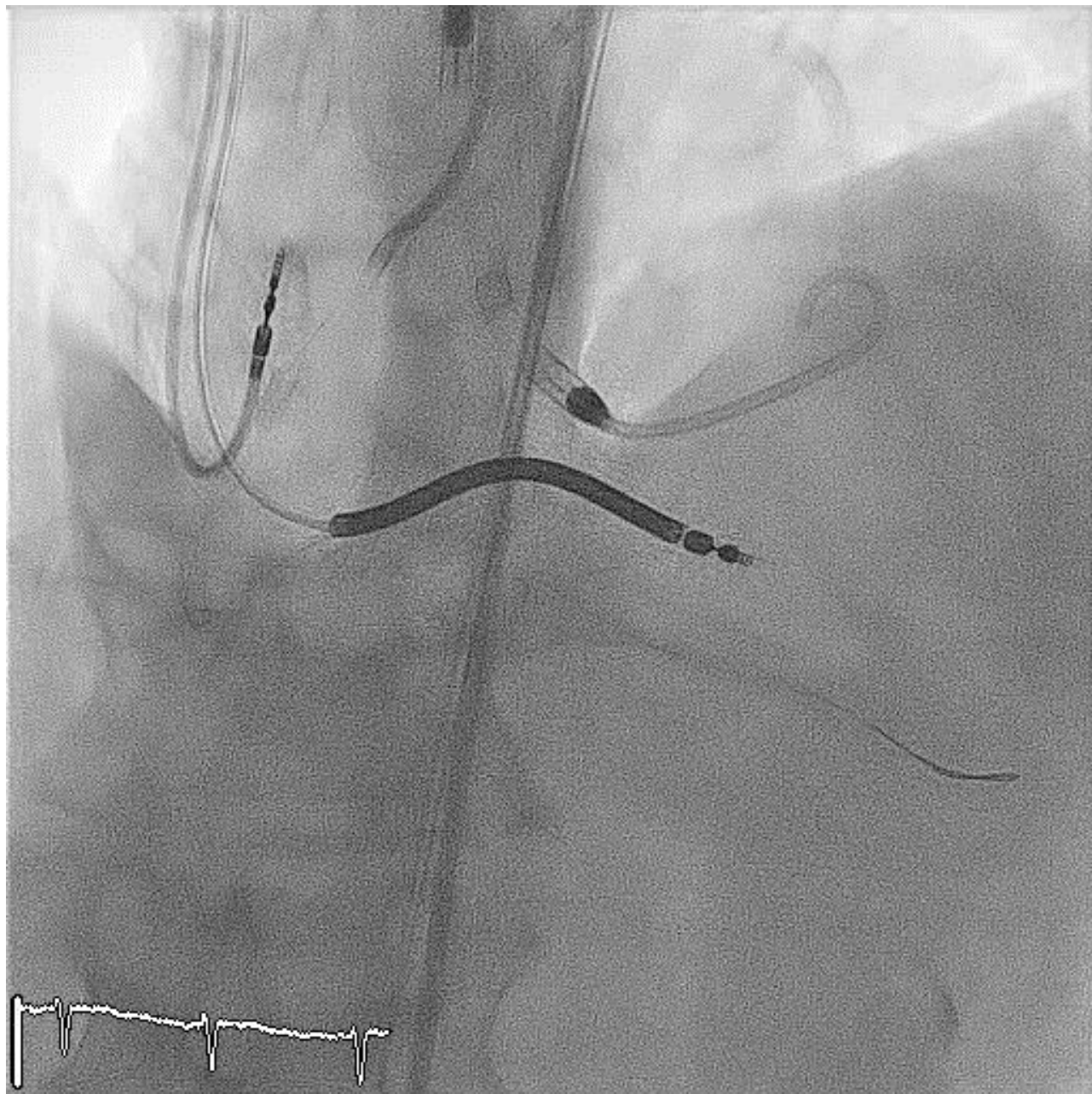












Cardiogenic shock in AMI

Rare — but still the leading cause of in-hospital death after MI

5–10 %

of AMI develop
cardiogenic shock

≈ 80 %

of AMI-CS are
due to LV failure

40–50 %

30-day mortality
despite PCI

≈ 60 %

of LV-dominant shock
follow anterior STEMI

Mortality in classic AMI-CS has plateaued since SHOCK (1999) — revascularisation alone is not enough.

Anterior STEMI carries the largest territory at risk → the highest risk of progression to refractory LV-dominant shock.

The MCS toolbox

Three percutaneous options — different physiology, different trade-offs

IABP	Impella CP	VA-ECMO
Flow ≈ 0.5 L/min	Flow 3.3–4.3 L/min	Flow 4–6 L/min
Unloading Indirect	Unloading Direct LV	Unloading Full bypass
Strength	Strength	Strength
Cheap, widely available	Only RCT-proven mortality benefit (DanGer)	Oxygenation + biventricular support
Limitation	Limitation	Limitation
No survival benefit (SHOCK-II)	Bleeding, limb ischaemia	↑ LV afterload, no mortality benefit (ECLS-SHOCK)

The Impella family

From bridge in high-risk PCI to surgical 5.5 support

Device	Access	Flow	Max duration	Typical role
Impella 2.5	13 Fr femoral	≈ 2.5 L/min	≤ 5 days	High-risk PCI (historical)
Impella CP	14 Fr femoral	3.3–4.3 L/min	≤ 5 days	AMI-CS (DanGer Shock device)
Impella 5.0 / 5.5	Surgical axillary 21 Fr	≈ 5.0 – 6.0 L/min	14–30 + days	Bridge to recovery / decision
Impella RP	23 Fr femoral vein	≈ 4.0 L/min	≤ 14 days	Isolated RV failure

In AMI-related LV-dominant shock, Impella CP is the device with randomised evidence. Upgrade to 5.5 for prolonged support or bridging.

IABP — why it fell from grace

IABP-SHOCK II: no mortality benefit at 30 days, 1 year or 6 years

39.7 %

vs

41.3 %

30-day all-cause mortality (IABP vs control)

RR 0.96 · p = 0.69

What the evidence told us

- 600 patients, AMI-CS, randomised to IABP or control.
- No difference in 30-day, 1-year or 6-year mortality.
- No difference in lactate, catecholamine dose or SAPS II.
- IABP provides only minimal augmentation of cardiac output and does not actively unload the LV.

Guideline consequence: Routine IABP in AMI-CS was downgraded to Class III (not recommended) in ESC 2017/2023.

ECLS-SHOCK: routine VA-ECMO – no benefit

NEJM 2023 · 417 patients · AMI-CS with planned revascularisation

ECMO group

47.8 %

30-day all-cause mortality

Control

49.0 %

Medical therapy ± bail-out

Effect

RR 0.98

Non-significant (p = 0.81)

Harms were not neutral

- Moderate / severe bleeding (BARC 3-5): **23 % vs 10 % (RR 2.44)**
- Peripheral ischaemic complications requiring intervention: **11 % vs 3.5 %**
- **Take-home:** unselected upfront VA-ECMO in AMI-CS cannot be recommended. Reserve for refractory shock after arrest, biventricular failure, or oxygenation requirements.

DanGer Shock — the game-changer

Design · NEJM 2024 · 14 centres in Denmark, Germany, UK

355 patients · STEMI + LV-dominant cardiogenic shock · 1 : 1 randomisation

Impella CP + standard care

- n = 179
- Impella CP implanted before or as soon as possible after PCI
- Target: full haemodynamic support
- Weaning driven by lactate / MAP / native pulsatility

Standard of care

- n = 176
- Primary PCI + inotropes / vasopressors
- Bail-out MCS allowed — mainly VA-ECMO
- Key exclusion: out-of-hospital arrest with coma (GCS < 8)

Primary endpoint: all-cause mortality at 180 days.

Source: [Møller et al., DanGer Shock, NEJM 2024](#)

DanGer Shock — the first positive RCT

180-day results · routine Impella CP reduces mortality in STEMI-shock

45.8 %

Impella CP

58.5 %

Standard care

−12.7 %

Absolute risk
reduction

NNT 8

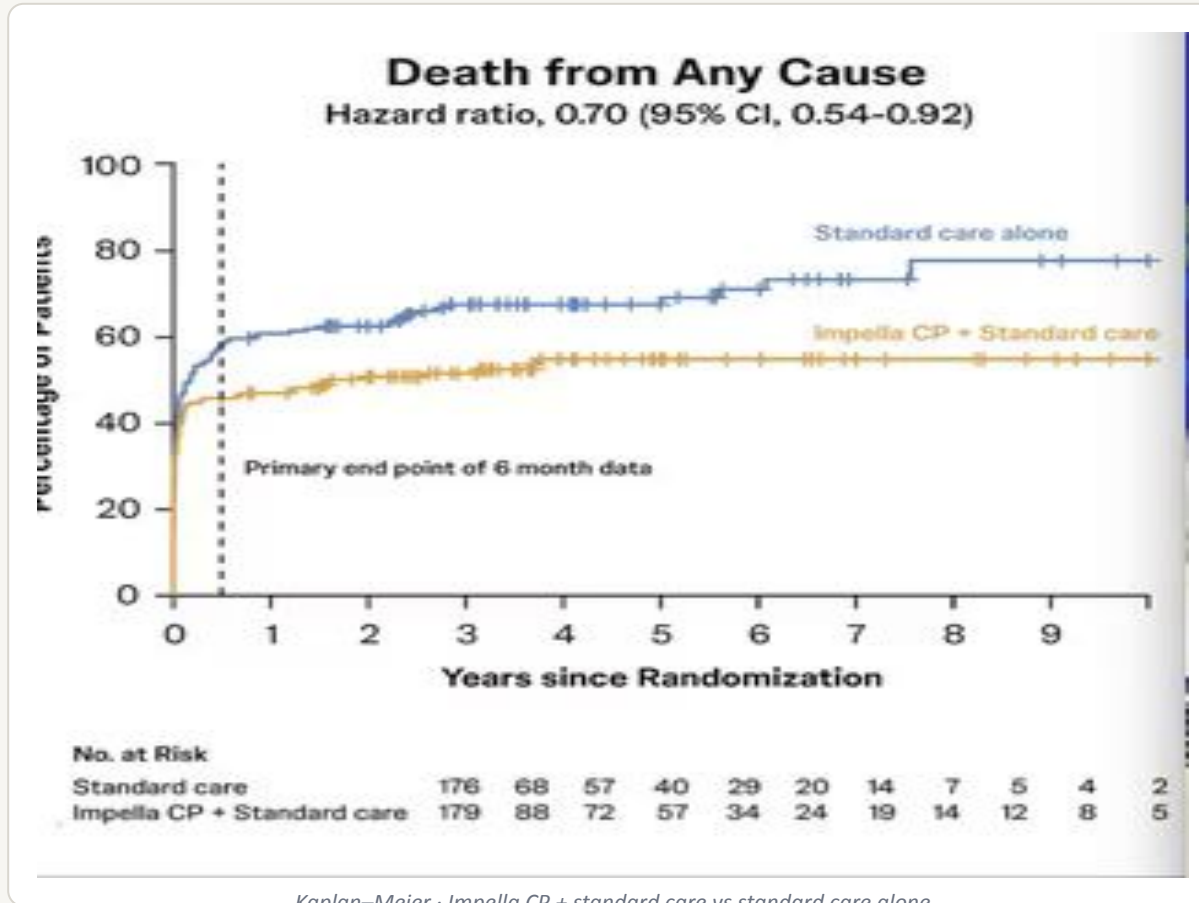
to save one life
at 6 months

What made this trial positive where others failed

- **Narrow inclusion:** STEMI with LVEF < 45 % and clear LV-dominant shock (lactate > 2.5, SBP < 100)
- **Exclusion of patients with anoxic brain injury** → benefit not diluted by futile cases
- Early device initiation, experienced centres, a structured weaning protocol

DanGer Shock — long-term follow-up

ESC 2025 · NEJM · benefit durable to 10 years



Kaplan-Meier · Impella CP + standard care vs standard care alone

-16.3 %

absolute mortality reduction

HR 0.70 (95 % CI 0.54 – 0.92) · + 600 days alive per patient

Why this matters

- All-cause mortality up to 10 y: **52.5 % vs 68.8 %**
- Median time to death: **577 d vs 61 d**
- First MCS device in AMI-CS with a durable RCT survival benefit.
- *Early unloading may prevent the post-infarct heart failure cascade.*

Timing matters — unload before reperfusion

Iannaccone meta-analysis · 13 studies · 6 810 AMI-CS patients

Pre-PCI Impella

37.2 %

short-term mortality
(n = 2 970)

During / Post-PCI Impella

53.6 %

short-term mortality
(n = 3 840)

Relative risk

RR 0.69

95 % CI 0.56–0.85

Midterm mortality

Pre-PCI 47.9 % vs **Post-PCI 73.0 %**

RR 0.81 (95 % CI 0.68–0.97)

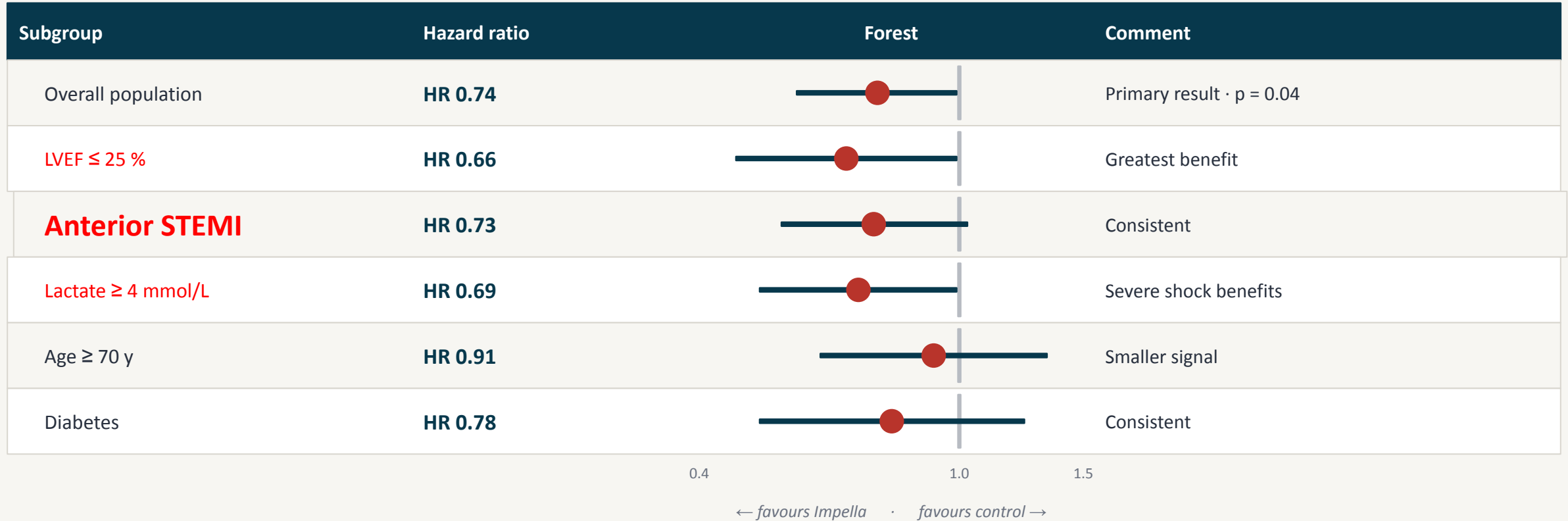
Safety — no penalty for early placement

- Device-related bleeding: comparable (RR 1.05)
- Limb ischaemia: comparable (RR 1.01)

Why it matters: unloading before reperfusion ↓ wall stress and MVO_2 , supports haemodynamics during the high-risk reperfusion phase, and may attenuate reperfusion injury.

DanGer Shock — who benefited most

Pre-specified subgroup signals (NEJM 2024)



Source: [Møller et al., DanGer Shock, NEJM 2024](#)

Why anterior STEMI kills

The LV failure spiral

1

Large LAD territory lost

Acute ↓ contractility · ↓ stroke volume · ↓ cardiac output

2

Neurohormonal activation

Catecholamines, RAAS → ↑ afterload, ↑ HR, ↑ MVO₂

3

Rising LVEDP

Pulmonary oedema, ↓ coronary perfusion pressure

4

Hypoperfusion & ischaemia

Lactate ↑ → multi-organ failure · SCAI D/E

Two therapeutic levers

Reperfuse

Restore epicardial & microvascular flow — **primary PCI**

Unload

Reduce wall stress, LVEDP and MVO₂ — **mechanical circulatory support**

In LV-dominant AMI-CS, unloading addresses the mechanism reperfusion alone does not fix.

Why unload the LV in STEMI?

Rationale — reperfusion injury, wall stress, and the “ventricle-first” hypothesis

The problem with reperfusion alone

Even with door-to-balloon < 90 min, 30–40 % of patients develop post-MI heart failure.

- Ischaemia-reperfusion injury contributes up to 50 % of final infarct size.
- Opening the artery also opens the door to oxidative stress, Ca^{2+} overload, mitochondrial injury, microvascular obstruction.
- Every 5 % increase in infarct size $\rightarrow \approx 20$ % relative increase in 1-year mortality.

The unloading hypothesis

Pre-PCI Impella reduces LV wall stress and MVO_2 — before the artery is reopened.

- $\downarrow$ Wall stress, $\downarrow$ oxygen demand during ischaemia.
- Activates cardioprotective signalling (SDF-1 α / CXCR4 axis) in preclinical models.
- Supports systemic haemodynamics during the fragile reperfusion phase.
- The testable hypothesis: smaller infarct $\rightarrow$ fewer patients progressing to heart failure.

DTU-STEMI Pilot — first-in-human proof

AHA 2018 · Circulation 2019 · Kapur et al. · n = 50

Design

- 50 anterior STEMI patients, 14 US centres
- Randomised: Impella CP + immediate reperfusion vs Impella CP + 30-min delayed reperfusion
- Primary safety: 30-day MACCE
- Primary efficacy: demonstrate NO increase in infarct size with delayed reperfusion (% of LV mass, CMR)

What the pilot showed

- ✓ Feasible: Impella CP placement + 30-min delay within a clinically acceptable window.
 - ✓ Safe: no significant difference in 30-day MACCE; zero bail-out from delayed arm.
 - ✓ A 30-min delay on the unloading platform did NOT increase infarct size.
 - ✓ No patient experienced no-reflow (expected rate $\approx 25\%$).
- Provocative subgroup: largest ST-elevation MIs — smaller infarct with unload + delay.

STEMI-DTU Pivotal 2026 — design

Multicentre RCT · JACC · presented ACC 2026 · Stone / Kapur et al.

Population	Intervention	Endpoints
• 527 adults • Anterior STEMI, no prior MI • No cardiogenic shock • 55 centres · US · Germany · Italy · Switzerland · Canada · UK	• 1 : 1 randomisation • Impella CP + 30-min delay → PCI • vs Immediate PCI alone • Mechanistic design, blinded core-lab CMR	• Primary: infarct size on CMR day 3–5 (% LV mass) • Key secondary: composite of 1-yr death, CS, HF, transplant, infarct size • Safety: device-related bleeding / vascular complications ≤ 30 d

Swiss participation: Switzerland was one of six participating countries — Centre Luzern contributed to this pivotal trial.

Source: [STEMI-DTU pivotal — JACC 2026](#), [J&J press release](#)

STEMI-DTU Pivotal — results

Neutral primary endpoint — but not the end of the story

Primary endpoint — infarct size (% LV mass, CMR d 3–5)

30.8 %

Impella CP + delayed PCI

vs

31.9 %

Immediate PCI alone

→ Neutral — no infarct-size reduction, no harm.

1-year mortality

3.6 % Impella arm

5.1 % Control arm

Numerically lower, not statistically significant.

Bleeding / vascular

- Device-related MB or VC: 30.8 % (>26.5 % performance goal)
- Any bleeding: 34 % vs 6 %
- Prolonged peri-procedural anticoagulation likely a driver

Mechanistic signal

- Pre-PCI TIMI flow significantly improved after 30 min of Impella support
- ↑ coronary perfusion pressure before PCI
- 100 % operator compliance with the protocol

Age subgroup

- Patients ≥ 61 y: trend toward smaller infarct (p = 0.056)
- >75 % of US STEMI patients are ≥ 65 y
- Hypertensive presentation may have limited LV unloading

Bottom line: no routine pre-PCI unloading in STEMI without shock — but the 30-min window is safe, feasible and biologically active (TIMI flow, older-patient signal).

Thank you

ECLS-SHOCK & CULPRIT-SHOCK — the defining RCTs

Two trials that shaped current VA-ECMO and revascularisation strategy

ECLS-SHOCK · NEJM 2023

Routine VA-ECMO in AMI-CS (n = 417)

30-day all-cause mortality

47.8% vs **49.0%** RR 0.98 (0.80–1.19), p = 0.81

Safety signals — consistently worse with ECLS

- Moderate / severe bleeding: **23.4%** vs **9.6%**
- Vascular complications (surgery / intervention): **11.0%** vs **3.8%**
- No benefit in any pre-specified subgroup (incl. arrest)
- 1-year mortality: 55.0% vs 55.8% — effect remains neutral

CULPRIT-SHOCK · NEJM 2017

Culprit-only vs immediate multivessel PCI (n = 706)

30-day death or renal-replacement therapy

45.9% vs **55.4%** RR 0.83 (0.71–0.96), p = 0.01

Key secondary results

- All-cause mortality: **43.3%** vs **51.5%** (RR 0.84, p = 0.03)
- Renal-replacement therapy: 11.6% vs 16.4% (NS)
- At 1 year: mortality difference no longer significant, but **more HF re-hospitalisation & repeat PCI**
- Established **culprit-only PCI as standard of care** in AMI-CS

Preventing the common complications

Three pitfalls that sink the DanGer benefit

Bleeding

UFH titrated to aPTT 50–60 s · avoid DAPT overshoot · minimise femoral lines · consider bivalirudin in high-risk patients · stop purge-heparin when switching to UFH.

Limb ischaemia

Mandatory pre-implant femoral ultrasound and angio · antegrade 6 Fr perfusion sheath if limb ischaemia develops · daily Doppler of the distal leg · early vascular surgery consult.

Haemolysis / position

Daily echo for inlet/outlet position · plasma-free Hb, LDH · reduce P-level or reposition promptly · consider early device exchange or explant if haemolysis persists.

A practical algorithm for 2026

From first contact to device decision in < 60 minutes

1 • Recognise

Suspect AMI-CS: hypotension, hypoperfusion, lactate > 2, LV dysfunction on bedside echo.

2 • Activate the shock team

Interventional cardiology, intensivist, cardiac surgery, anaesthesia, perfusionist.

3 • Reperfuse

Primary PCI of the culprit first. Complete revascularisation later (CULPRIT-SHOCK).

4 • Support

Anterior STEMI + LV-dominant shock → Impella CP early. Add/convert to VA-ECMO for RV failure, arrest, hypoxia.

5 • Wean or escalate

Re-assess at 12–24 h: lactate, MAP off pressors, pulsatility. Escalate to Impella 5.5 / LVAD / transplant if no recovery.

Source: [Thiele et al., CULPRIT-SHOCK, NEJM 2017](#)

What is coming — open questions for 2026 – 2028

Trials that will reshape the field

RECOVER IV

halted — post-DanGer

Original n = 560 STEMI-CS trial stopped in 2024 after DanGer; successor trial in design to confirm DanGer in a broader international population.

OASIS-AMICS

prospective (J&J)

Observational Assessment of Support with Impella Best Practices — tests which practices reduce adverse events and improve survival in the post-DanGer era.

STEMI-DTU — long-term

n = 668

Pivotal primary endpoint neutral at ACC 2026; CMR sub-studies, 1-year MACCE and HF-hospitalisation follow-up ongoing.

PIONEER EXTEND

n ≈ 220

Extended Impella 5.5 support beyond 14 days in AMI-CS and acute decompensated HF — bridge-to-recovery strategies.

The sicker they are, the more they gain

DanGer Shock post-hoc — SBP at randomisation (JAMA Cardiol 2025)

SBP < 82 mmHg

OR 0.34

vs standard care (95% CI 0.18–0.63; $p < 0.001$)

Largest survival benefit — the hypotensive phenotype is where DanGer worked.

SBP $\geq$ 82 mmHg

OR 0.96

vs standard care (95% CI 0.53–1.70; $p = 0.90$)

No detectable mortality benefit — bleeding / vascular risk remains.

Clinical implications

- SBP at randomisation is a robust signal of treatment benefit — the p-for-interaction was 0.02.
- Risk of major bleeding, AKI, limb ischaemia and stroke did NOT differ across SBP strata — harms are SBP-independent.
- Practical rule: the lower the SBP at cath-lab arrival, the stronger the case for early Impella — provided neuro-status and LV-dominant physiology are present.

Are US and Europe really aligned?

Concordance and the few points of divergence

Concordant (core pathway)

- Early revascularisation is the single biggest survival lever (Class I).
- Routine IABP and routine upfront VA-ECMO in AMI-CS are Class III in both.
- Culprit-only PCI in shock at the index procedure (CULPRIT-SHOCK) — Class III in both.
- Shock team + regional transfer to MCS-capable centres — strong consensus on both sides.
- VA-ECMO reserved for refractory shock / arrest / oxygenation failure.

Where they differ

- Impella CP in STEMI-CS: ACC/AHA upgraded to Class 2a (2025); ESC still on the older 2023 text — focused update expected.
- AATS expert consensus went further: 91% of surveyed surgeons favour Class 1 in AMI-CS.
- Staged non-culprit PCI post-shock: ACC/AHA Class 2a; ESC makes no explicit statement

What we still need to learn

Open questions the shock community is tackling right now

Confirmation outside Scandinavia

DanGer enrolled in Denmark, Germany and the UK. A broader international confirmatory trial (post-RECOVER IV) is in design.

Best-practice standardisation

OASIS-AMICS prospective study (J&J) tests which practices — access, pre-PCI timing, weaning, anticoagulation — most reduce adverse events.

Who benefits if SBP $\geq$ 82 mmHg?

Post-hoc signal suggests no mortality benefit above the median SBP. Needs prospective confirmation.

Extending support beyond 14 days

PIONEER EXTEND: can Impella 5.5 bridge to recovery / decision in patients who cannot be weaned in the first week?

Reducing bleeding / vascular harm

Purge-solution optimisation (bicarbonate), bivalirudin-based AC, closure-first pathways — all being tested.

Biomarker-guided weaning

Lactate trajectory and CPO thresholds for safe explant — registries and single-centre protocols converging.

Source: [Kapur — OASIS-AMICS \(TCTMD\)](#), [RECOVER IV — halted](#)

So — Impella for all anterior STEMIs?

NO — but...

for a well-defined subset, the evidence is now strong enough to act.

Yes — consider Impella CP

- ✓ Anterior STEMI with AMI-CS (SCAI C/D)
- ✓ LV-dominant shock, neuro-intact
- ✓ Early — pre- or peri-PCI, before lactate spirals
- ✓ Centre with shock team + vascular-access pathway

No — do not default to Impella

- ✗ Uncomplicated STEMI without shock
- ✗ RV-dominant or biventricular failure (consider ECMO)
- ✗ Refractory arrest with unclear neuro status
- ✗ Severe PAD, active bleeding, AI > mild

Bottom line: *select the right patient, deploy early, run a shock-team pathway — and engineer bleeding out of the protocol.*

Thank you

Questions & discussion

Pascal Meier

Cardiology · HFR Fribourg

VA-ECMO — powerful, but a double-edged sword

Full cardiopulmonary bypass at the bedside

Strengths

- Biventricular support + oxygenation
- Rapid deployment, bedside implantation
- Bridge in refractory arrest (ECPR)
- Useful when isolated Impella is insufficient (ECPELLA)

Limitations

- ↑ LV afterload → distension, pulmonary oedema
- Bleeding and vascular complications frequent
- Harlequin / North–South syndrome
- Often requires venting (IABP / Impella)
- **No mortality benefit in AMI-CS (ECLS-SHOCK)**

SCAI SHOCK classification (2022 update)

Three pillars: clinical exam · haemodynamics · biochemistry



Clinical exam

Normal JVP, warm, alert — no signs of shock	Warm, well perfused — early signs of compromise	Cold, clammy, altered mentation, oliguria, pulmonary oedema	Any C + not responding to initial therapy	In extremis — refractory arrest / ongoing CPR / near-death
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Haemodynamics

Normotensive, no vasopressors	SBP < 90 or MAP < 65 or ↓ 30 mmHg from baseline, HR > 100 — no hypoperfusion	Hypotension despite volume; needs vasopressor / inotrope / MCS	Escalation of vasopressors / inotropes or addition of MCS	Profound hypotension despite maximal support; multiple devices
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Biochemistry

Lactate normal, renal / liver function preserved	Lactate normal, minimal renal dysfunction	Lactate ≥ 2 mmol/L, rising Cr, ↑ BNP, LFTs	Lactate still ≥ 2 or worsening; rising Cr, LFTs	Lactate ≥ 8, severe acidosis (pH ≤ 7.2), multi-organ failure
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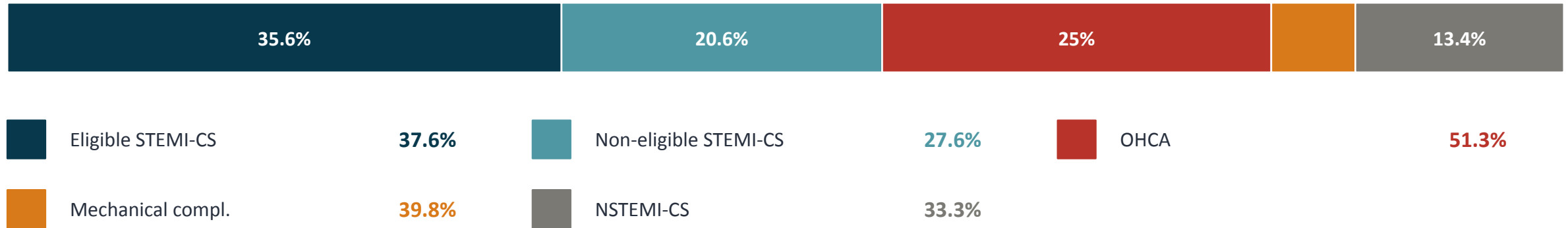
Key 2022 updates: lactate ≥ 8 mmol/L for stage E, coma as modifier after cardiac arrest.

Source: [Naidu et al., SCAI SHOCK Update, JACC 2022](#), [Kapur et al., Circ Heart Fail 2022](#)

Real-world validation — J-PVAD registry

Japanese nationwide registry · 3 975 AMI-CS patients treated with Impella

Patient mix



Take-aways from the registry

- Only **1 in 3 real-world AMI-CS patients** meets the DanGer Shock criteria.
- OHCA subgroup has the worst outcomes — device use here often futile without early ROSC.
- Time from shock onset to Impella was shortest in the Eligible group (4 h vs 6–10 h) — **early deployment is the actionable lever.**

Case 1 — Rescue with early Impella

62-year-old · anterior STEMI · SCAI C → recovery



What went well

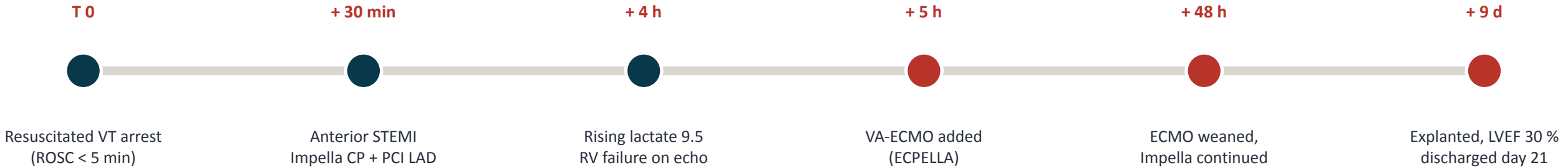
- ✓ Shock recognised early — SCAI C, conscious patient
- ✓ Impella CP placed **before** the first balloon — US-guided access
- ✓ Structured weaning once lactate < 2 and MAP 70 off pressors
- ✓ Closure with Perclose ProStyle + 6 Fr antegrade perfusion

Teaching points

- Time from shock onset → device: 15 min — in line with J-PVAD best quartile
- Pre-PCI unloading: consistent with 16 % absolute mortality reduction signal
- LVEF recovery 20 % → 38 % supports the LV-unloading hypothesis

Case 2 — Escalation to ECPELLA

54-year-old · refractory biventricular shock · bridge to recovery



Key decisions that changed the trajectory

- Rising lactate despite adequate Impella flow = early warning of unmet oxygenation / RV failure — don't wait.
- ECPELLA configuration: ECMO restores systemic perfusion, Impella continues to vent the LV and prevents pulmonary oedema.
- Wean ECMO first (driven by native pulsatility and lung function), keep Impella as bridge until myocardial recovery.
- Daily shock-team rounds: echo, lactate, end-organ markers, vascular assessment, family conversation.

Weaning from Impella — a step-wise protocol

Predictors of successful weaning · UPMC + single-centre data

Haemodynamic readiness criteria

- ✓ MAP $\geq$ 65–75 mmHg off escalating vasopressors
- ✓ Lactate $<$ 2 mmol/L or down-trending $\geq$ 48 h
- ✓ Cardiac power output $>$ 0.6 W
- ✓ Pulsatility returning on arterial line
- ✓ Right atrial pressure $<$ 15 mmHg, PAWP $<$ 20
- ✓ No active bleeding, stable haemoglobin, normalising lactate
- ✓ **LVEF $\geq$ 30 % on echo at onset of weaning**

Step-wise protocol

- 1 • Decrease P-level by 1 every 2 – 8 h
- 2 • Check lactate, urine output, creatinine 2 h after each step
- 3 • Echo at P3: LVEF, RV function, LVOT opening
- 4 • Tolerate P2 $\geq$ 120 min with stable haemodynamics
- 5 • Explant in ICU / cath-lab with closure plan ready

Red flag: any rise in lactate during the first 12 – 24 h of weaning predicts death — pause and reassess.

VA-ECMO vs IABP — the meta-analytic evidence

Mortality signal small, bleeding and vascular harm consistent

RR 0.88

In-hospital mortality

VA-ECMO + IABP vs VA-ECMO alone
42 studies · 8 759 pts

OR 0.36

30-day / in-hospital mortality

VA-ECMO + IABP vs VA-ECMO in AMI-CS
(Frontiers Cardiovasc Med 2023)

~2-3 ×

Severe bleeding vs IABP alone

Consistent signal across VA-ECMO
observational series and RCTs

Bleeding & vascular harm

- VA-ECMO (ECLS-SHOCK): moderate / severe bleeding **23.4% vs 9.6%**, vascular surgery **11.0% vs 3.8%**
- Adding IABP **lowers GI bleed (3.9 vs 8.1 %) and haemorrhagic stroke (1.9 vs 4.1 %)**
- Limb ischaemia and infection remain increased with combined circuits
- All RCT- and meta-analytic signals come from observational data — hypothesis-generating only

What this means at the bedside

- Do not add IABP to VA-ECMO routinely — the mortality signal is modest and observational
- Consider IABP venting when LV distension / pulmonary oedema is the dominant problem
- Impella is the preferred venting device when anatomy and bleeding risk allow (ECPELLA)
- Reserve all combined-device strategies for MCS-experienced shock centres

Source: [Li et al., meta-analysis VA-ECMO ± IABP \(Front Cardiovasc Med 2024, 8 759 pts\)](#), [Frontiers Cardiovasc Med 2023 \(AMI-CS\)](#), [ECLS-SHOCK — safety data](#)

Devices do not save lives — teams do

What a MCS-ready programme looks like



24 / 7 on-call

Interventional + intensivist + CT-surgery + perfusionist



Vascular access

Ultrasound-guided puncture, angiography of access, closure plan



ICU pathway

Dedicated MCS nurses, lactate trend, daily echo, ventilation strategy



Quality & audit

Case review, device registry, shock team debrief, SSIC benchmarking



Transfer network

Early referral from spoke hospitals — mobile ECMO where needed



Shared decision

Daily recovery / escalation / withdrawal discussion with the family

Building the programme at HFR Fribourg

From first referral to recovery — integrated shock pathway

1

Referral network

Direct-to-cath-lab pathway with EMS and spoke hospitals across canton Fribourg and the Romandie.

2

Shock activation

Single phone call triggers interventional + intensivist + anaesthesia + perfusionist.

3

MCS capability

Impella CP (no 5.5), VA-ECMO, no on-site cardiac surgery, 24/7 cath-lab coverage.

4

Team debriefing

Debriefing with the team — intensive care, anaesthesists, ambulance and emergency service — on the day.

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Preventing the common complications

Three pitfalls that sink the DanGer benefit

Bleeding

UFH titrated to aPTT 50–60 s · avoid DAPT overshoot · minimise femoral lines · consider bivalirudin in high-risk patients · stop purge-heparin when switching to UFH.

Limb ischaemia

Mandatory pre-implant femoral ultrasound and angio · antegrade 6 Fr perfusion sheath if limb ischaemia develops · daily Doppler of the distal leg · early vascular surgery consult.

Haemolysis / position

Daily echo for inlet/outlet position · plasma-free Hb, LDH · reduce P-level or reposition promptly · consider early device exchange or explant if haemolysis persists.

The price of support

Bleeding, limb ischaemia and renal replacement are real

Safety event	Impella CP	Standard
Severe bleeding	21.8 %	11.9 %
Limb ischaemia	5.6 %	1.1 %
Renal replacement	41.9 %	26.7 %
Haemolysis	6.7 %	0 %
Device / composite safety	Higher in Impella arm	—

Consequence for practice: survival benefit is real, but device-related morbidity demands a dedicated programme — vascular imaging, ultrasound-guided puncture, closure strategy, and proactive anticoagulation management.

Source: [Møller et al., NEJM 2024](#)

Who benefits — and who does not

Selection is the single most important variable

Likely to benefit

- ✓ Anterior STEMI with LV-dominant shock
- ✓ LVEF $\leq$ 45 %, rising lactate, low MAP
- ✓ Conscious / neurologically intact patient
- ✓ Suitable femoral anatomy ($\geq$ 6 mm, no severe PAD)
- ✓ Early device deployment — before escalating pressors

Futile or harmful

- ✗ OHCA with GCS < 8 and no early signs of recovery
- ✗ Isolated RV shock (use Impella RP or ECMO instead)
- ✗ Severe aortic regurgitation or LV thrombus
- ✗ Small LV, severe peripheral artery disease