

Management of Electrical Storm

김 성 환

가톨릭의대 서울성모병원 순환기내과

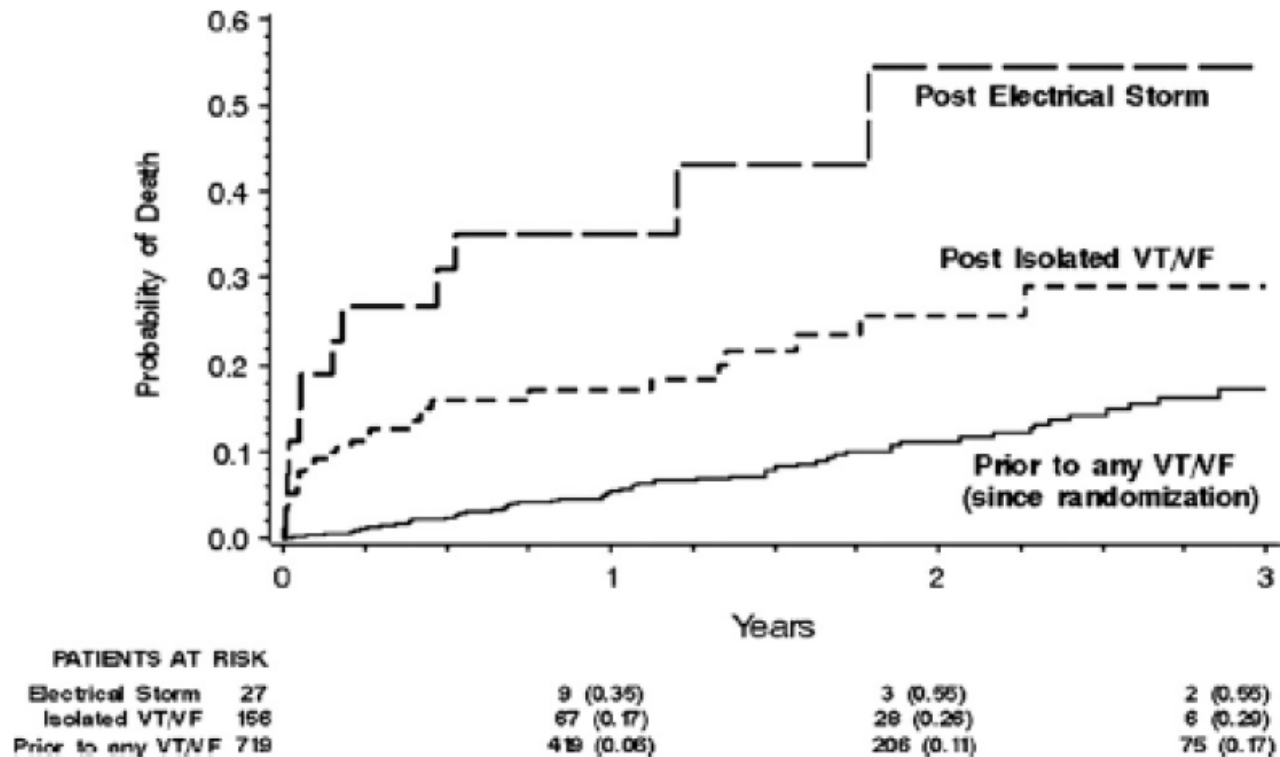
Definition

- **≥ 3** sustained episodes of VT, VF, or appropriate shocks from an ICD **within 24 hours**

Incidence

- For primary prevention, 4% for 21 months (in a MADIT II trial)
- For secondary prevention, 20% for 31 months (in a AVID trial)
- Within the first 3 months after a storm
 - The highest risk of death

Clinical outcomes of electrical storm



Huang et al. MADIT II. *Heart Rhythm* 2007

Reversible factors

- **Acute ischemia**, worsening heart failure, hypokalemia, anti-arrhythmic drug, alcohol, hyperthyroidism, infection.....

Clinical presentations

1) Monomorphic VT

- structural heart ds. (reentry)

2) Polymorphic VT

- acute ischemia (normal QT), torsades de pointes (prolonged QT)

Clinical presentations

3) Ventricular fibrillation

- ischemia, inherited primary arrhythmia syndrome
- Brugada syndrome
 - 5~40%
 - predisposing factors: hypokalemia, a high vagal tone, bradycardia, and fever
 - Treatments: isoproterenol, quinidine, cilostazol ?

Pharmacologic therapy

Nonpharmacologic therapy

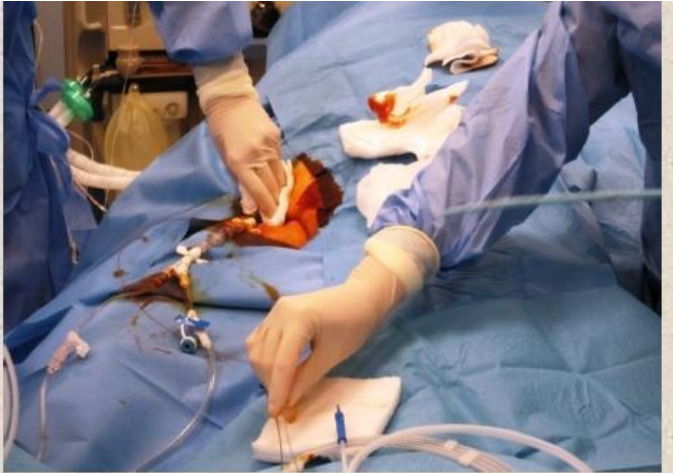
1) IABP, percutaneous LV assist device

- dramatically relief for ischemia burden, afterload, and wall tension.

2) Extracorporeal membrane oxygenation

- life support as well as myocardium saving
- RFCA for unstable hemodynamic VT

Extracorporeal membrane oxygenation



Nonpharmacologic therapy

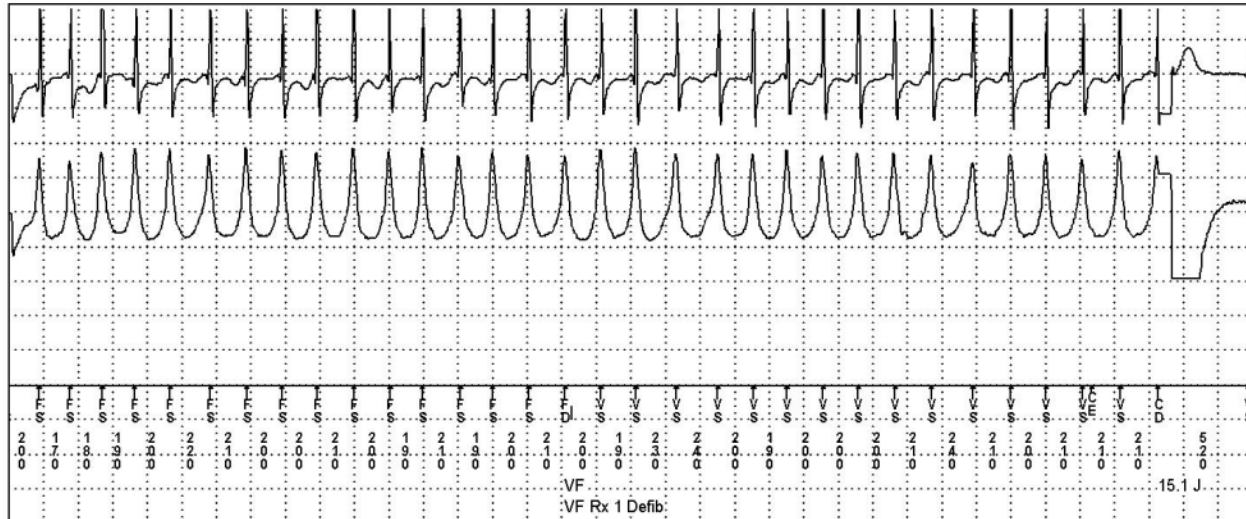
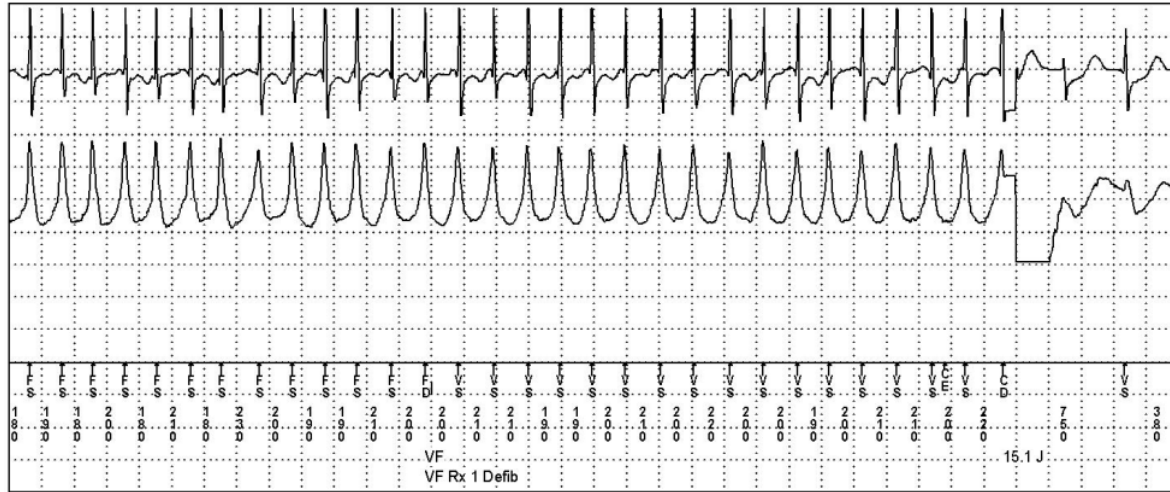
3) RFCA

- Monomorphic VT, polymorphic VT/VF by specific triggers (PVC)

Case: c/c recurrent shock

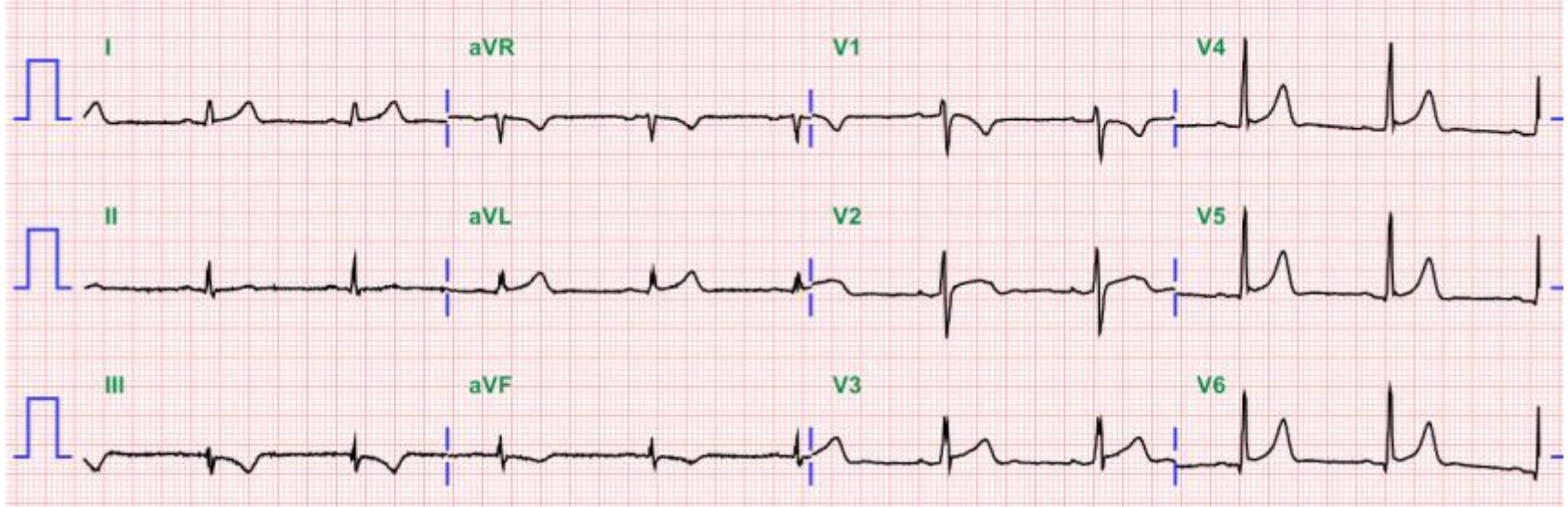
- M/31
- 2012.7 cardiac arrest -> VT -> ICD refuse
- 2014.3 palpitation -> VT
 - > refer to our hospital
 - > ICD insertion
- 2014.5~11 appropriate shock #5
- 2014.12 shock #3/day

ICD interrogation

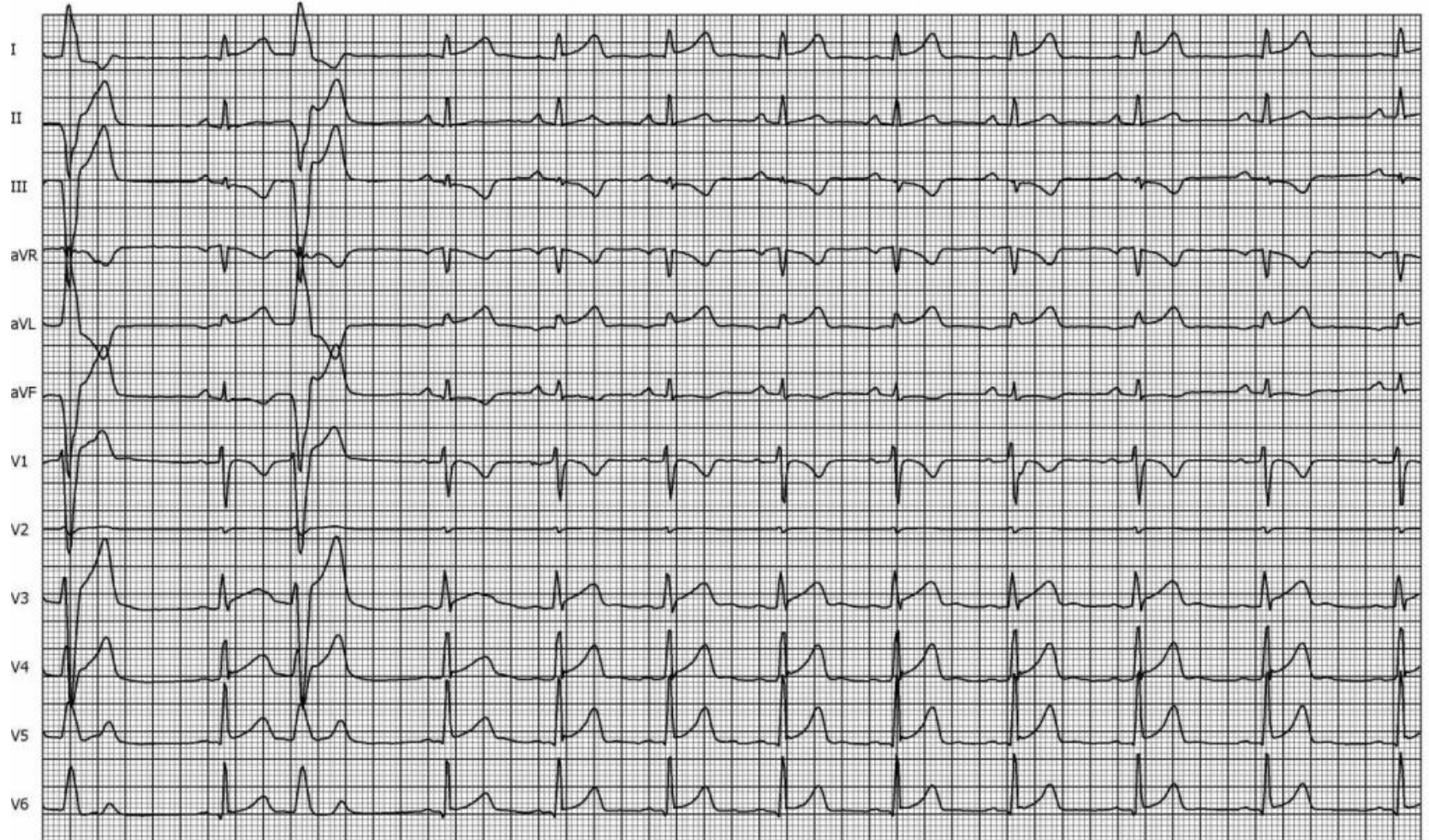


Work up

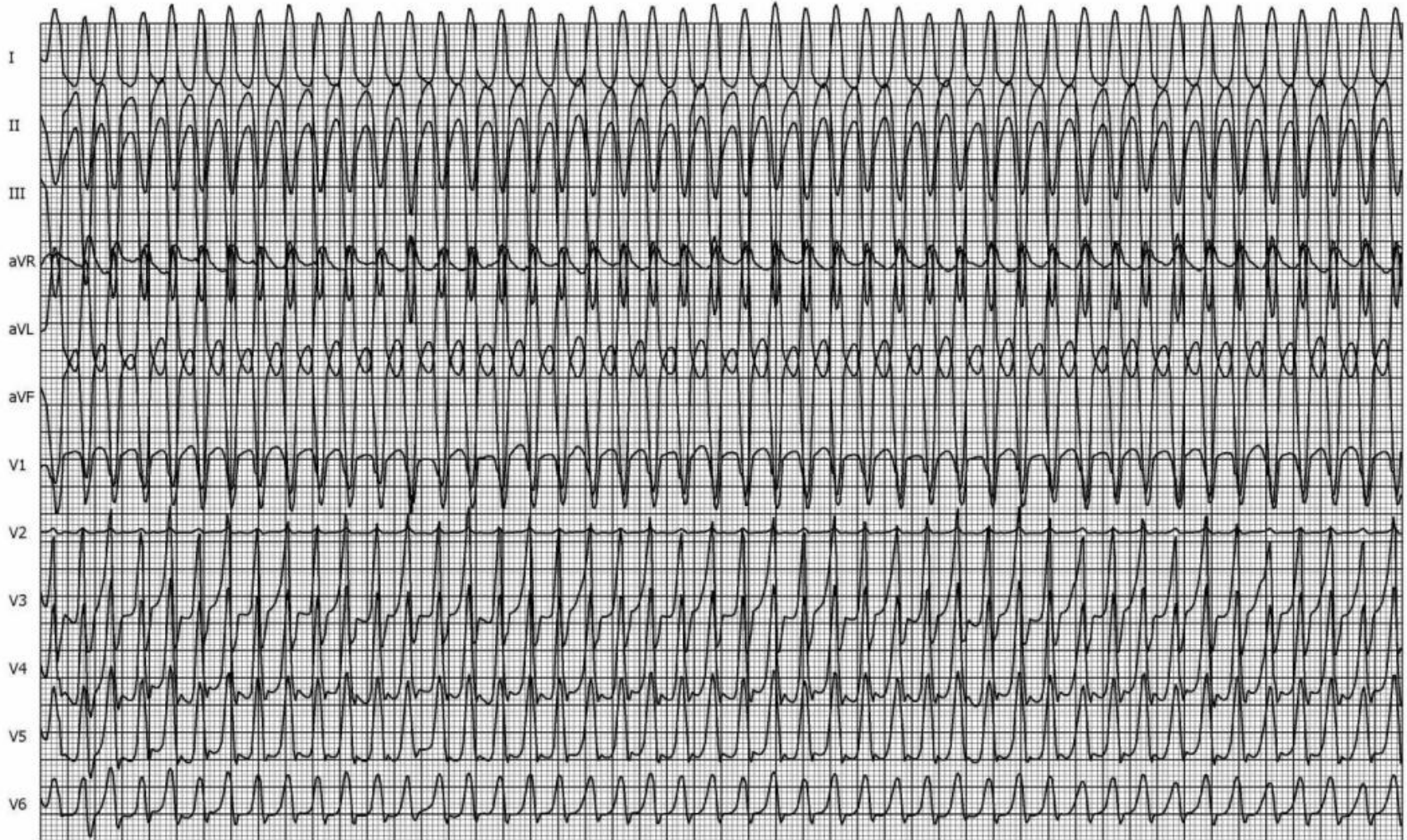
- Echo, CAG, treadmill, heart MR, flecainide provocation: all normal



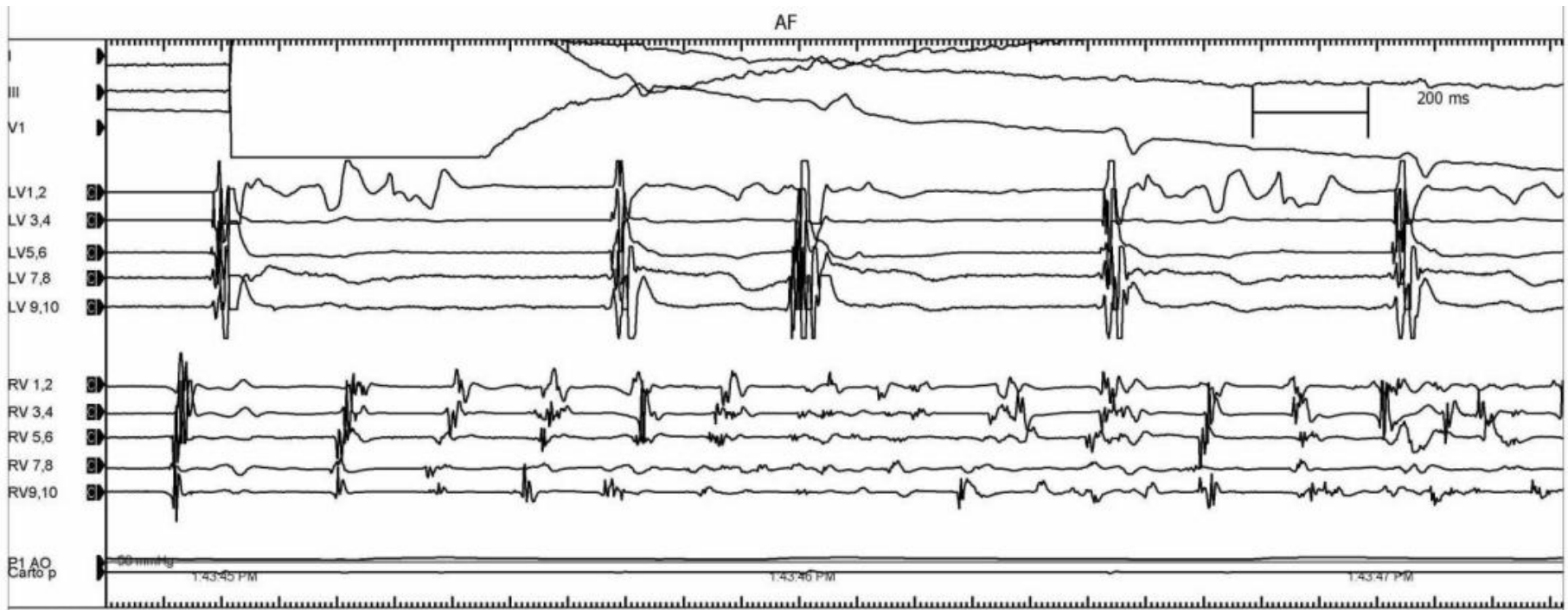
initial



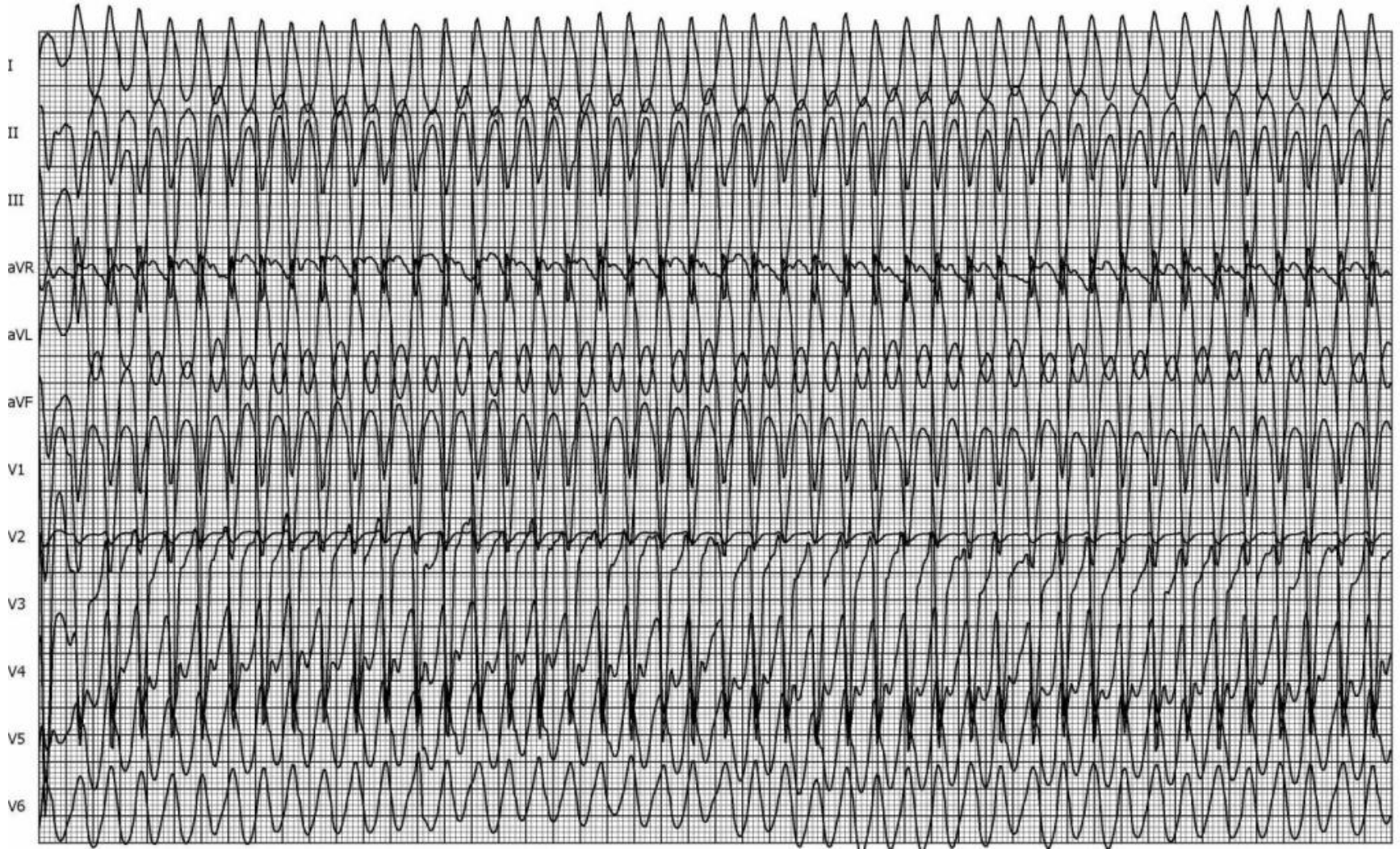
by RV apex pacing (200 ms)



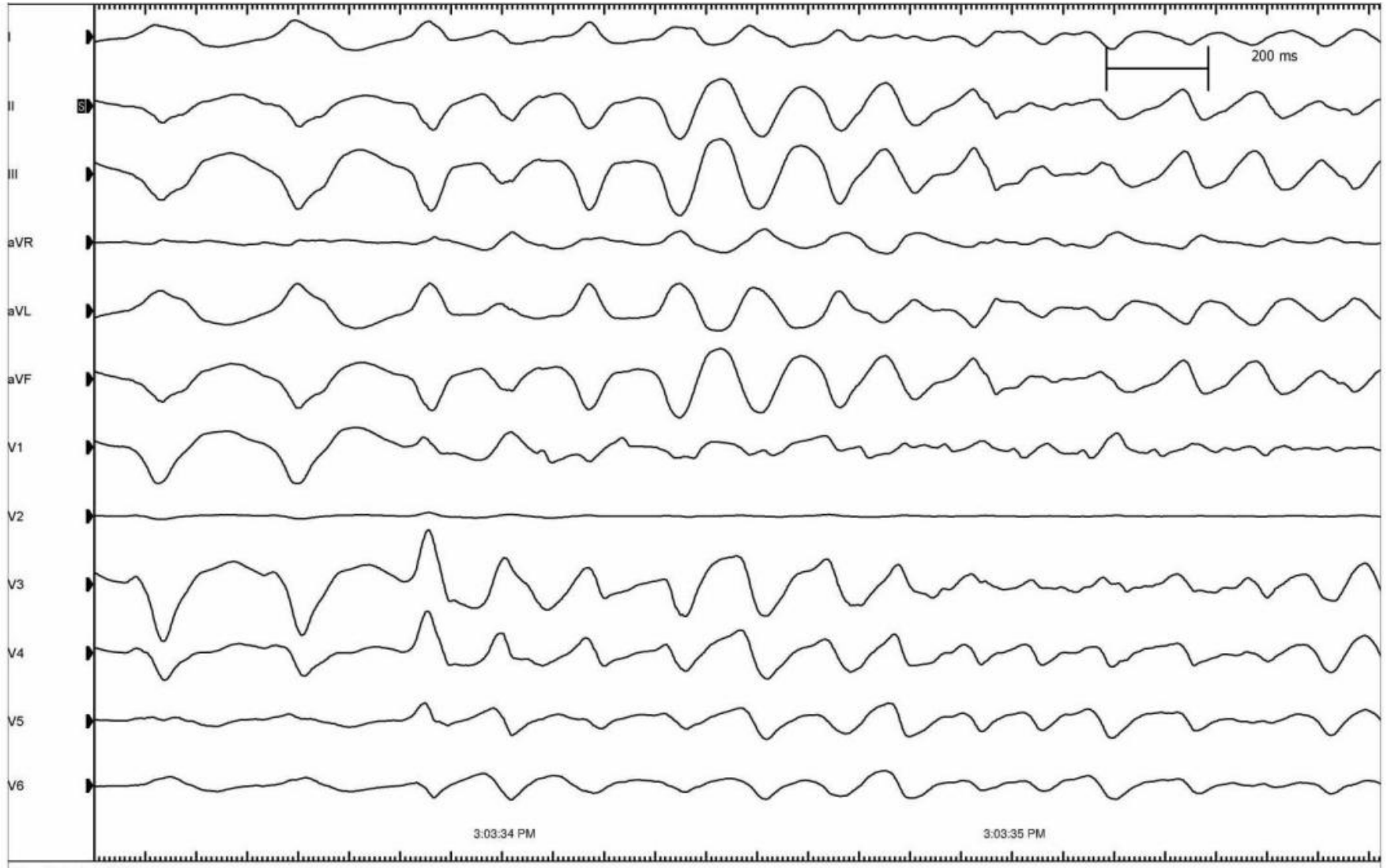
Shock followed by transient AF



VT 3

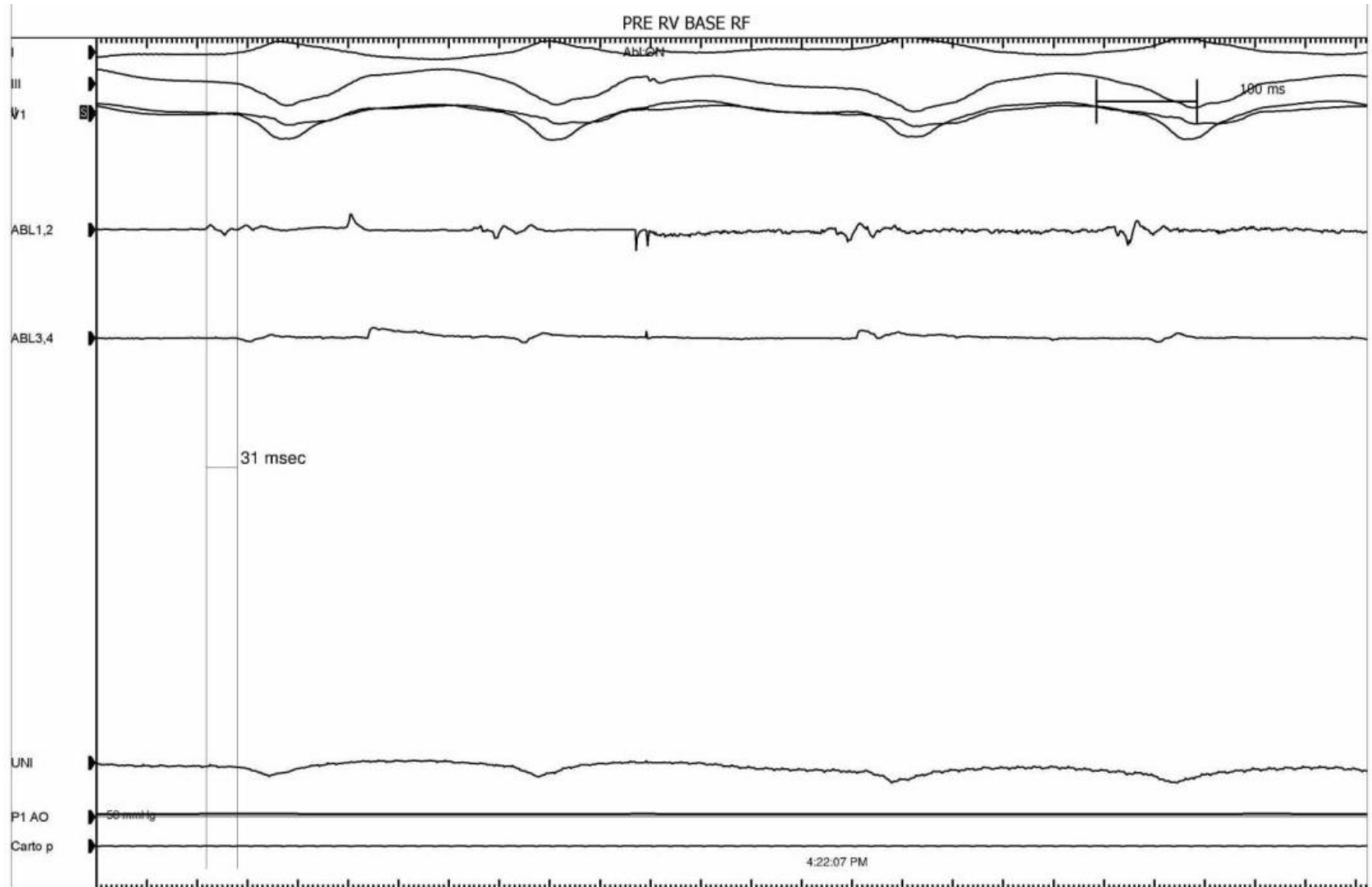


Degeneration to VF

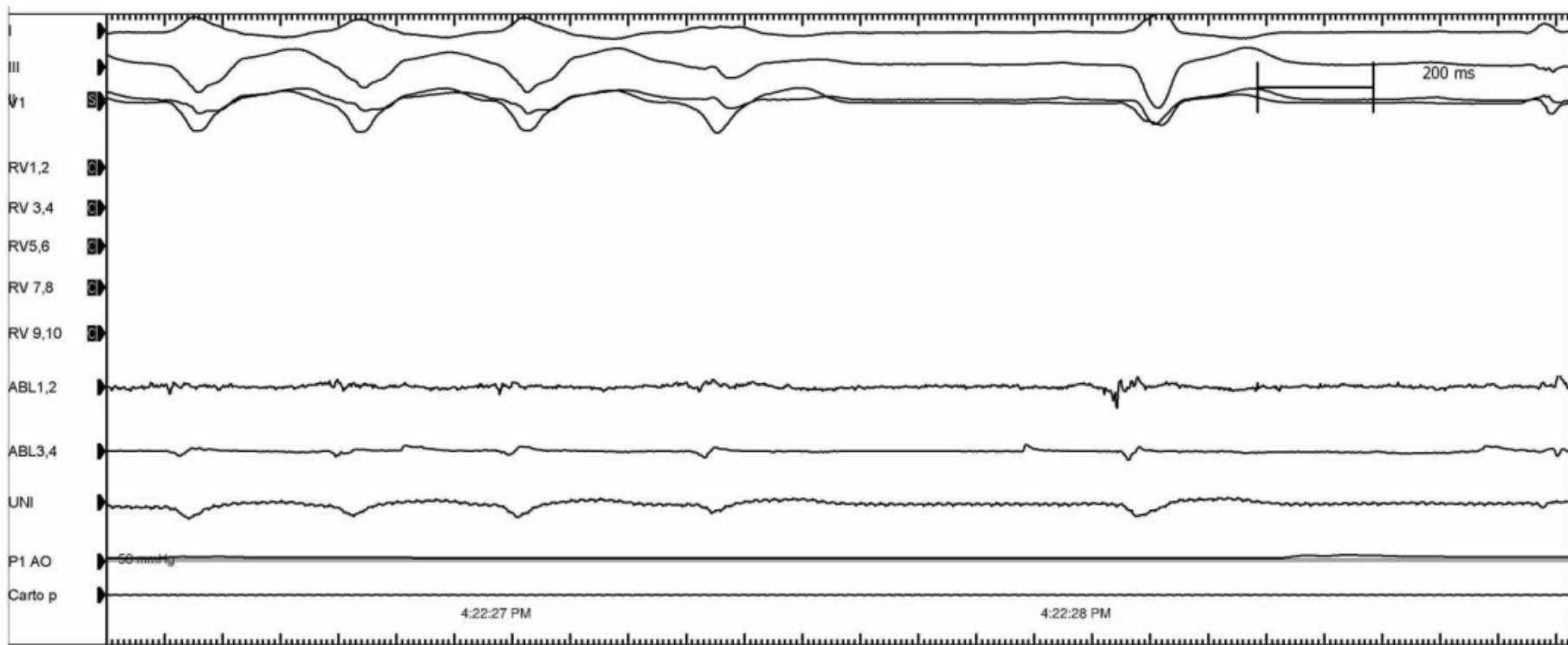


- ECMO insertion
 - life support as well as myocardium saving
 - RFCA for unstable hemodynamic VT

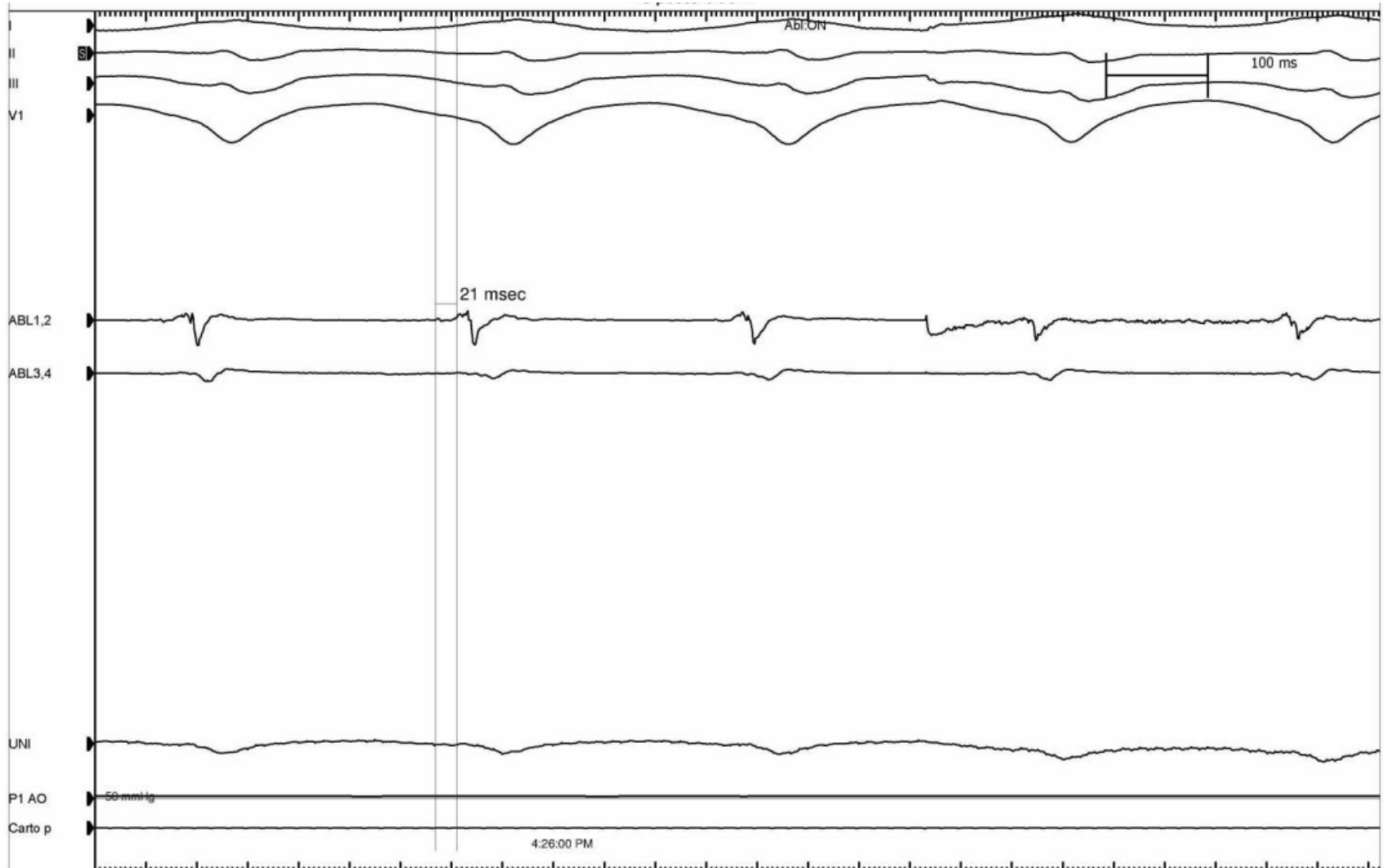
The earliest activation



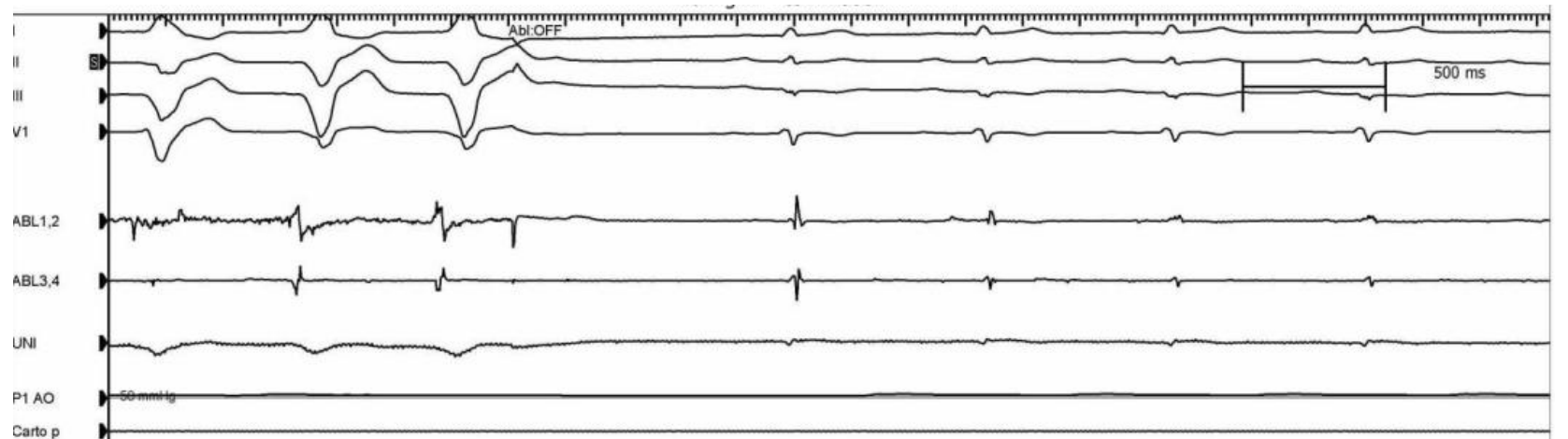
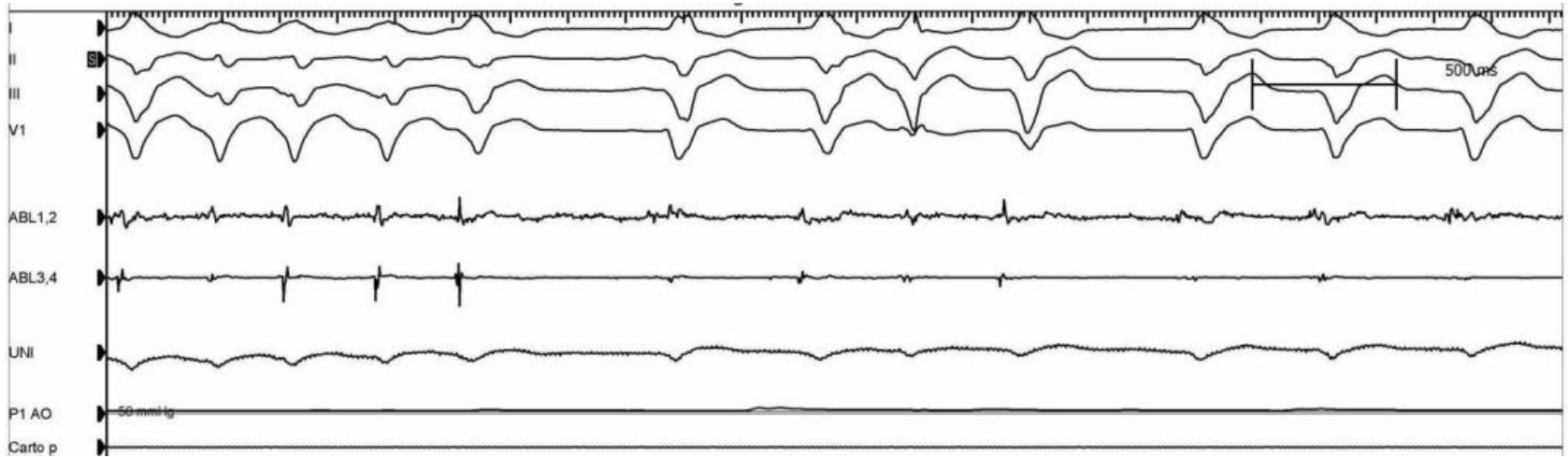
Termination after 20 sec.



Another VT (RV basal posterolateral)



Slow down and termination



Summary

- Check points
 - reversible factor, monomorphic/polymorphic/VF, ischemia?, prolonged QT?
- Pharmacologic therapy
 - Brugada (J wave syndrome? Idiopathic VF?): isoproterenol, quinidine, cilostazol?

Summary

- Non-pharmacologic therapy
 - Revascularization
 - IABP, LAVD
 - ECMO : life support, myocardium saving, circulation support during RFCA