

Interesting case presentation

Arrhythmogenic role of LAA in PeAF ablation

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Case I

1st Procedure

□ Ablation Summary (2004. male / 20yr)

- Baseline AF -> External Cardioversion 150J failed
- Segmental ablation with electrical isolation of 4 PVs.
- Spontaneous Termination after Cardioversion
- Roof ablation and PMI ablation
- IRAF was evaluated with isoproterenol and IRAF was not shown
from LA & RA

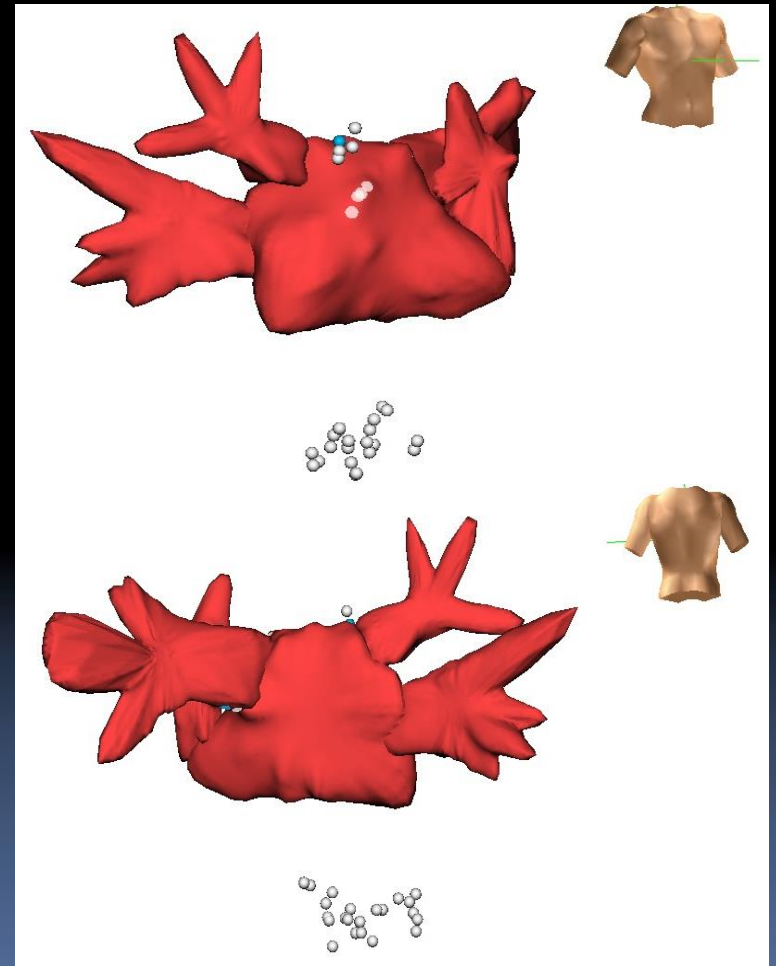
2nd Procedure

□ Baseline (2006. 22yr)

- Baseline SR
- Lt common pulmonary vein showed reconnected PV potential.
- PMI block

□ Ablation Summary

- Segmental ablation with electrical isolation of Lt common PV.
- CTI Block & SVC Isolation
- Induced CSOs AT -> CSOs ABL
- Induction test was performed and sustained AF or AT were not induced.



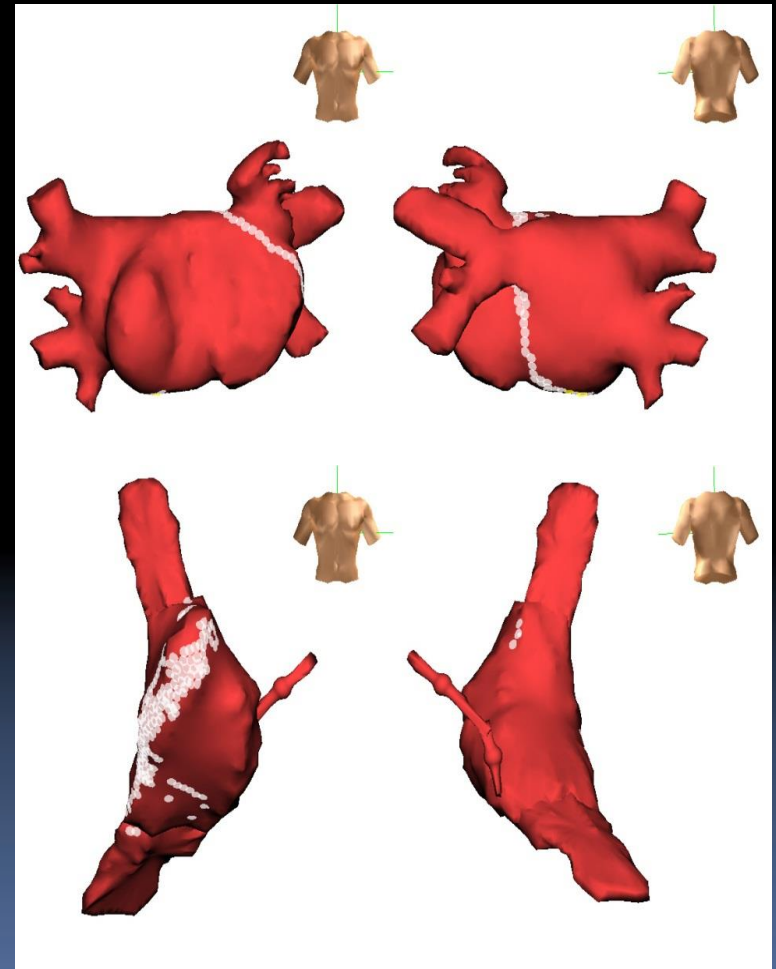
3rd Procedure

□ Baseline (2009. 25yr)

- Baseline AF
- Recurrence of PV potentials were not observed at all 4 PVs.

□ Ablation Summary

- LA CFAE Map & Ablation
- RA CFAE Map & Ablation
- Internal CV and External CV was performed, AF changed into slow AT, finally terminated.
- All procedure was finished without performing inducibility test

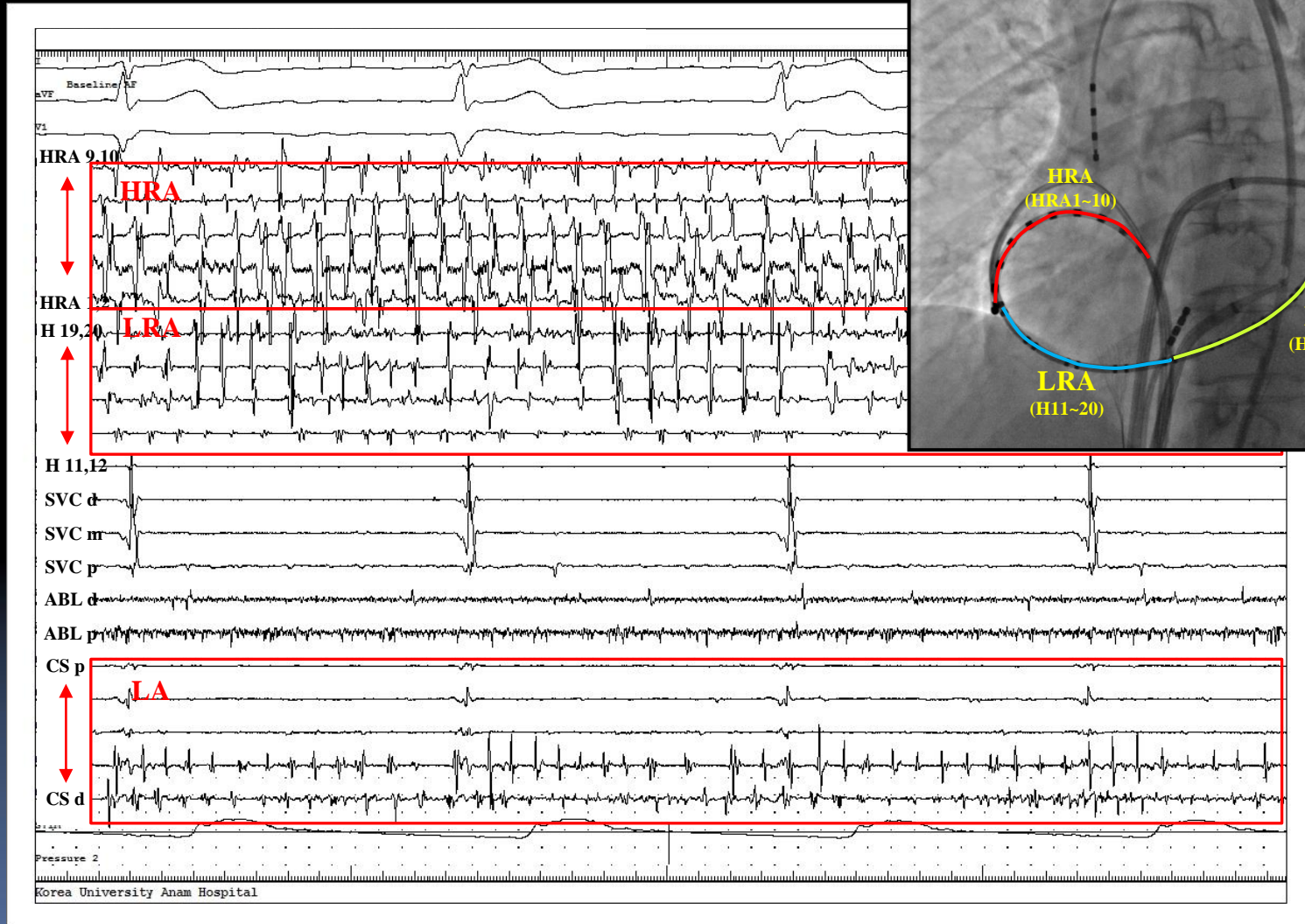


4th Ablation procedure

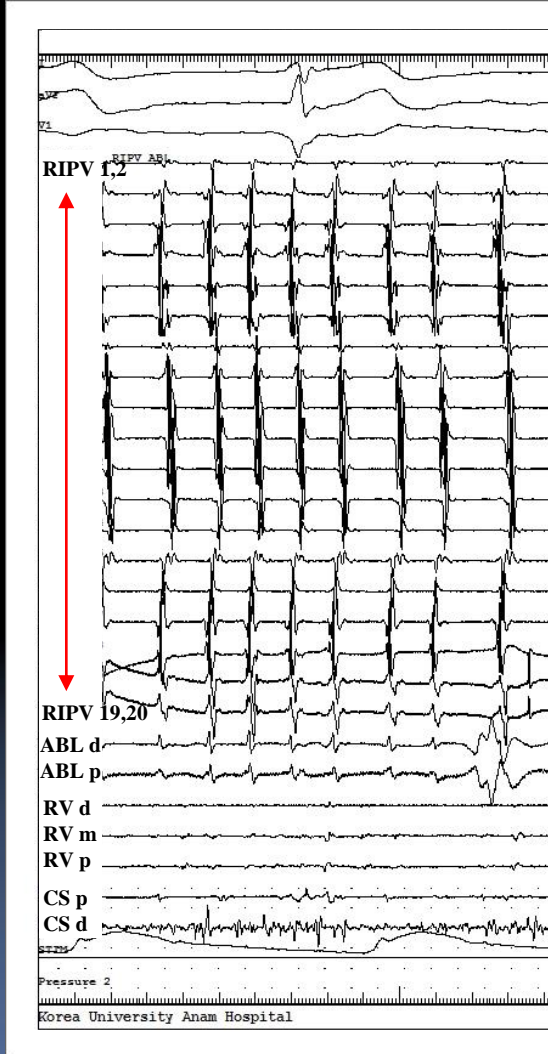
- ❑ 2012. 12 / 29yr
- ❑ Baseline AF
- ❑ LSPV, LIPV, RSPV : No PV Potential
- ❑ RIPV PV Potential reconnected



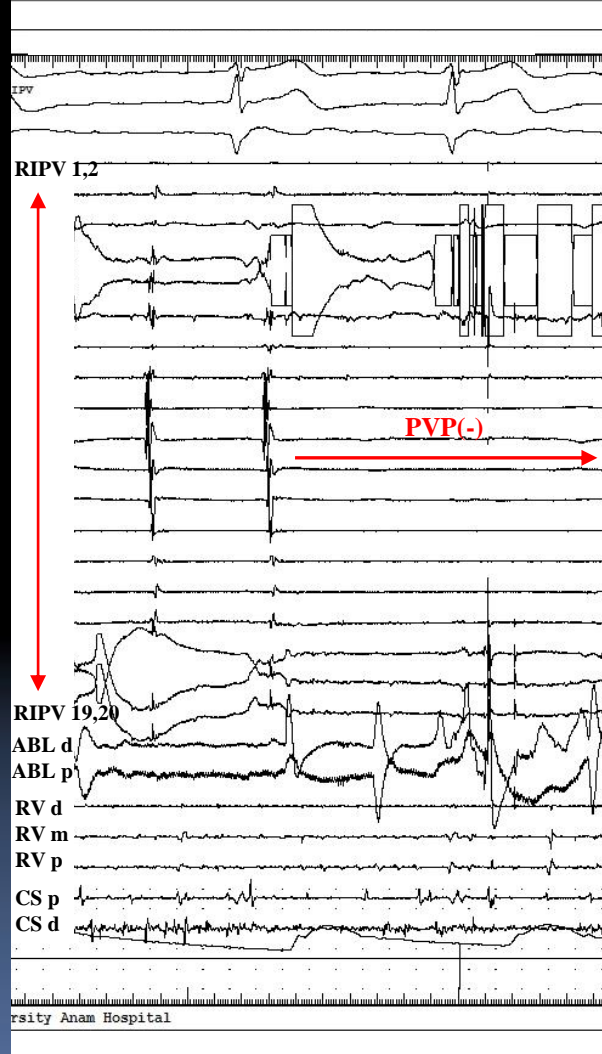
Baseline AF



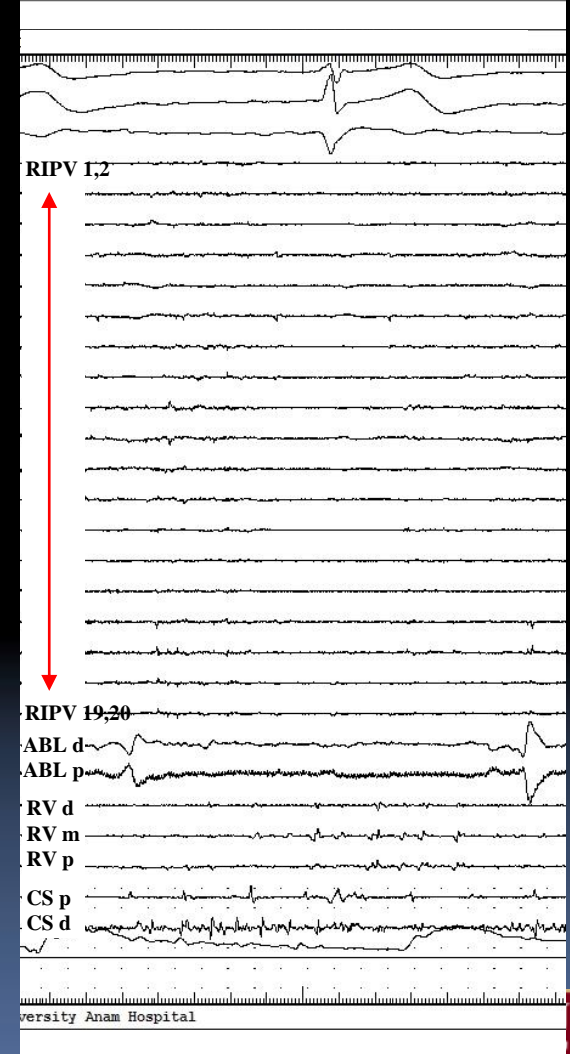
RIPV ABL



Baseline



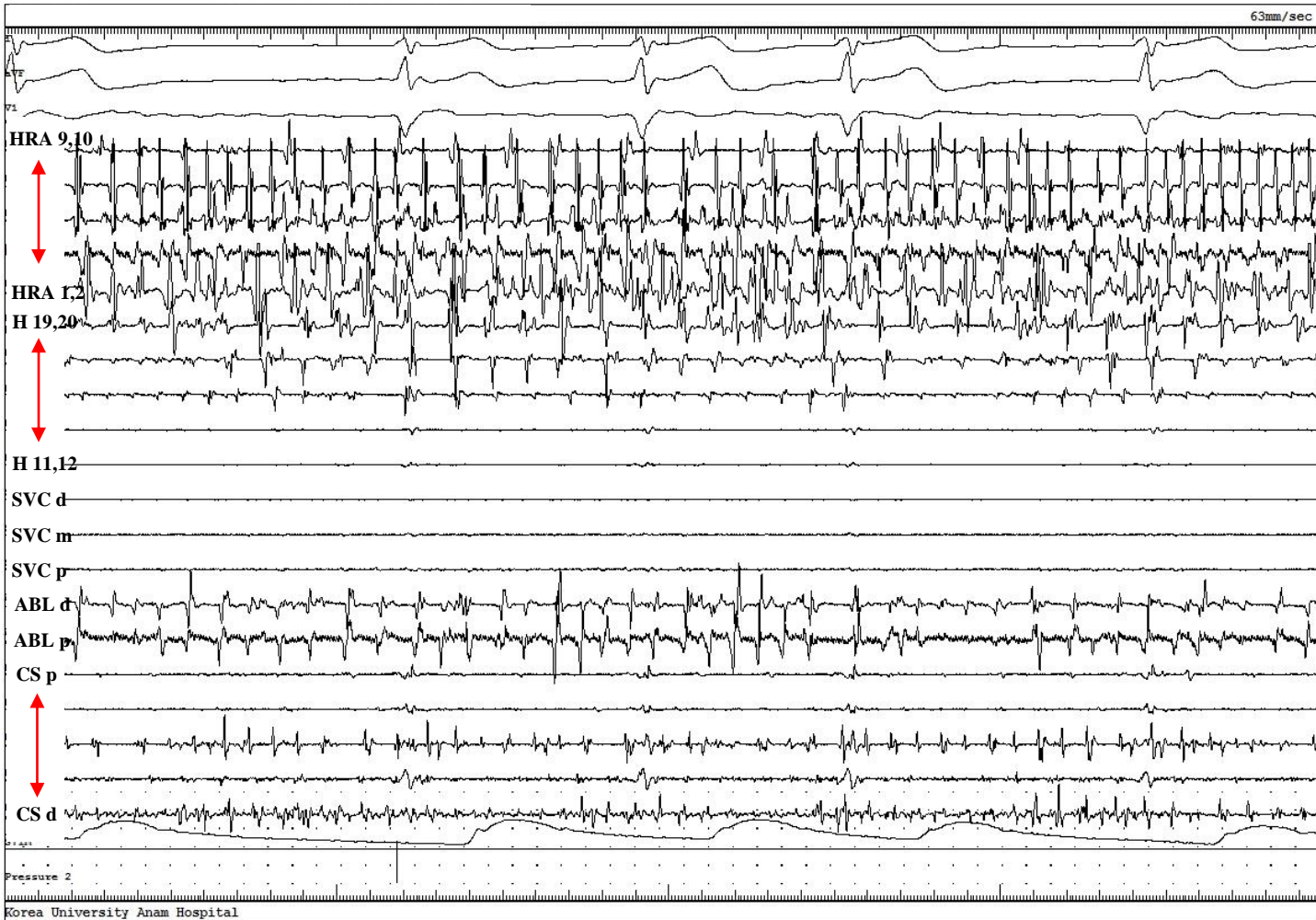
During ABL



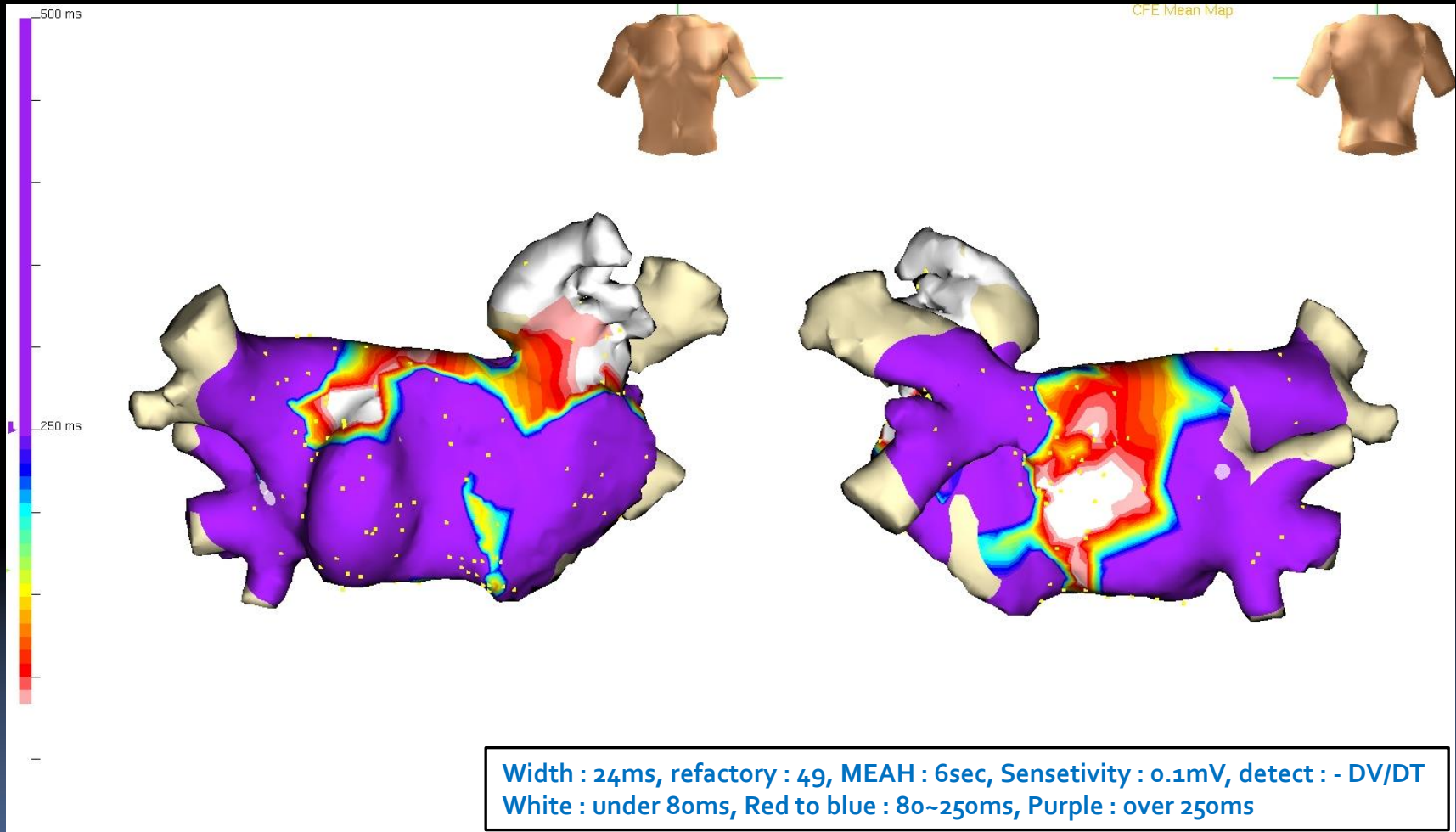
Post ABL



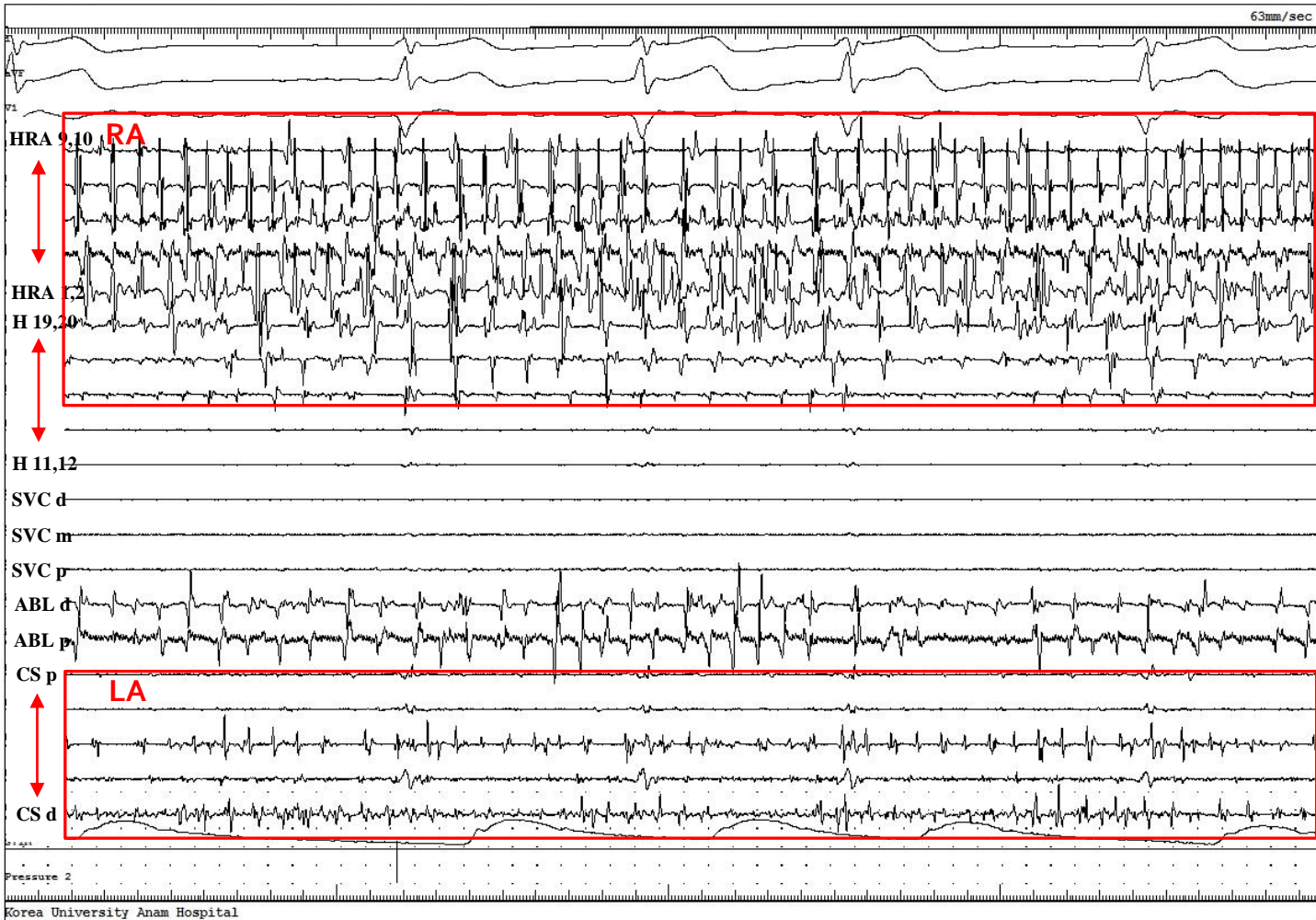
Post PV Isolation



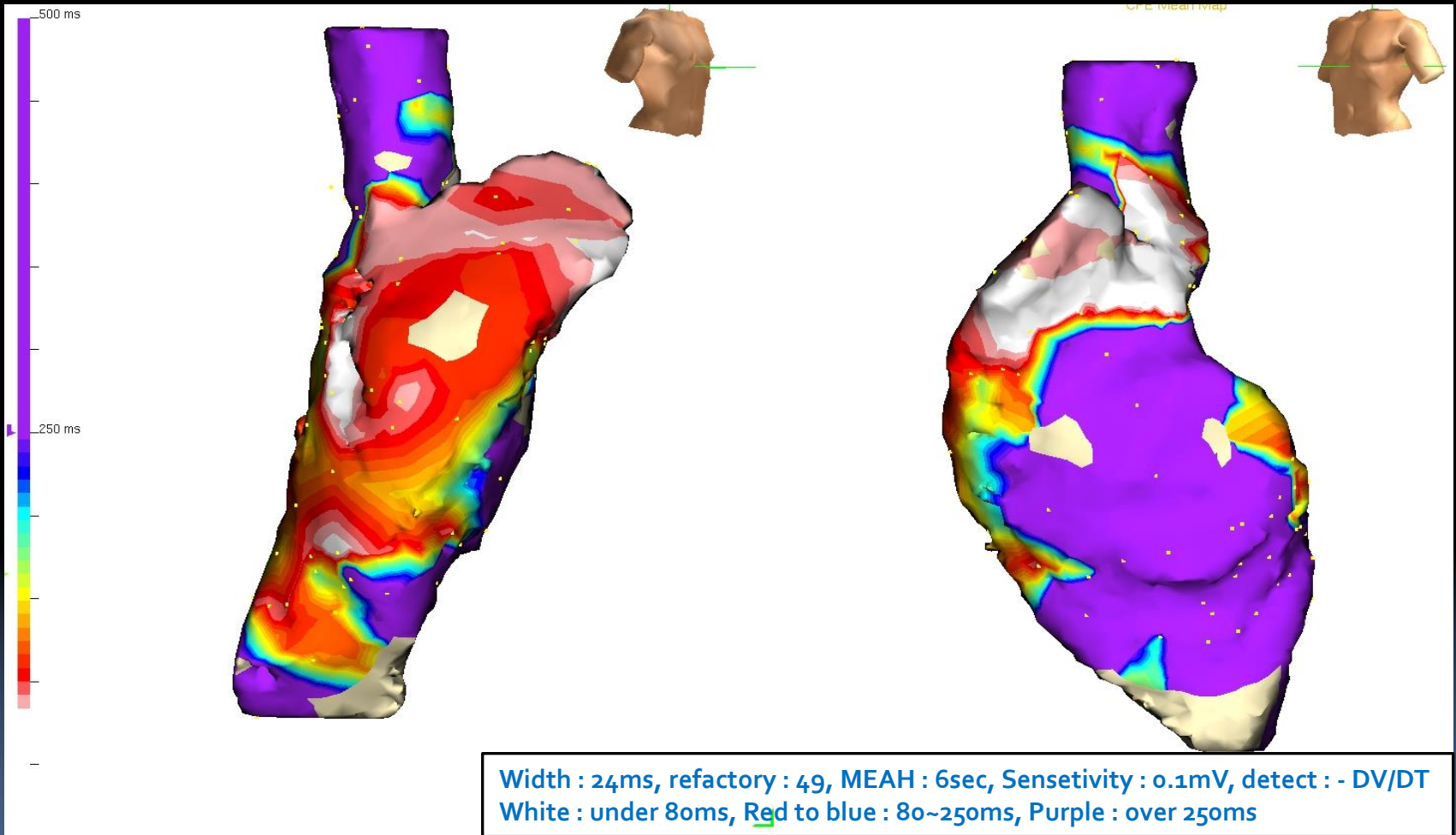
LA CFAE Map



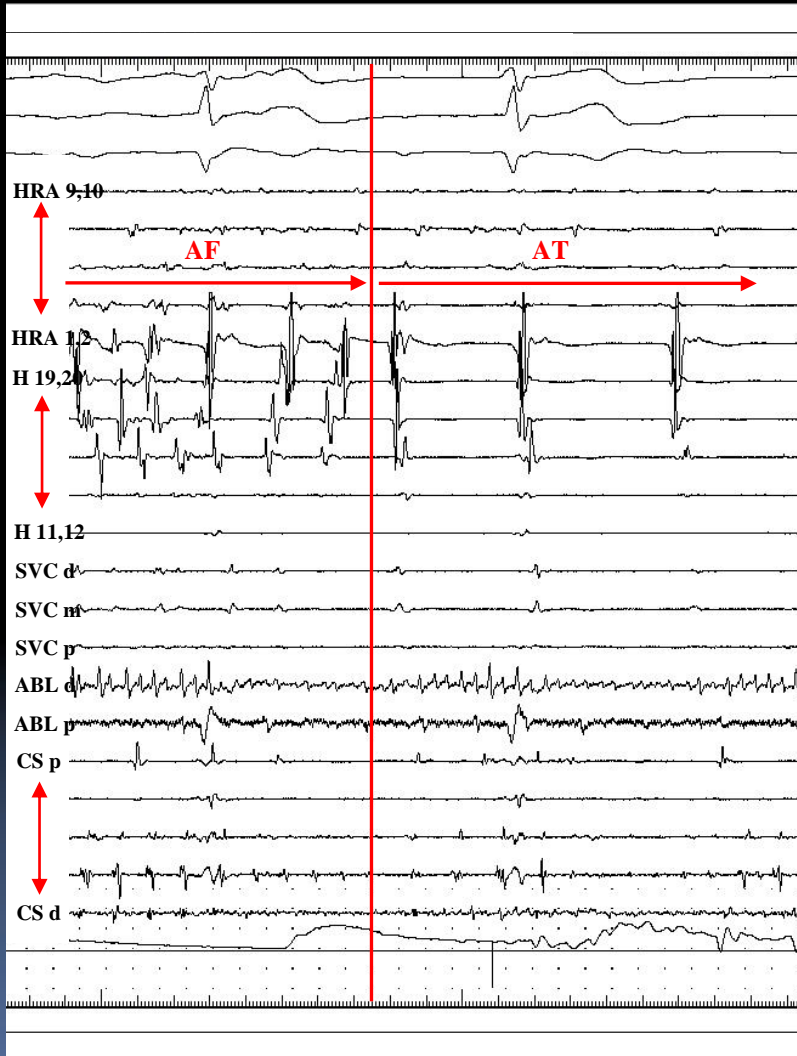
AF



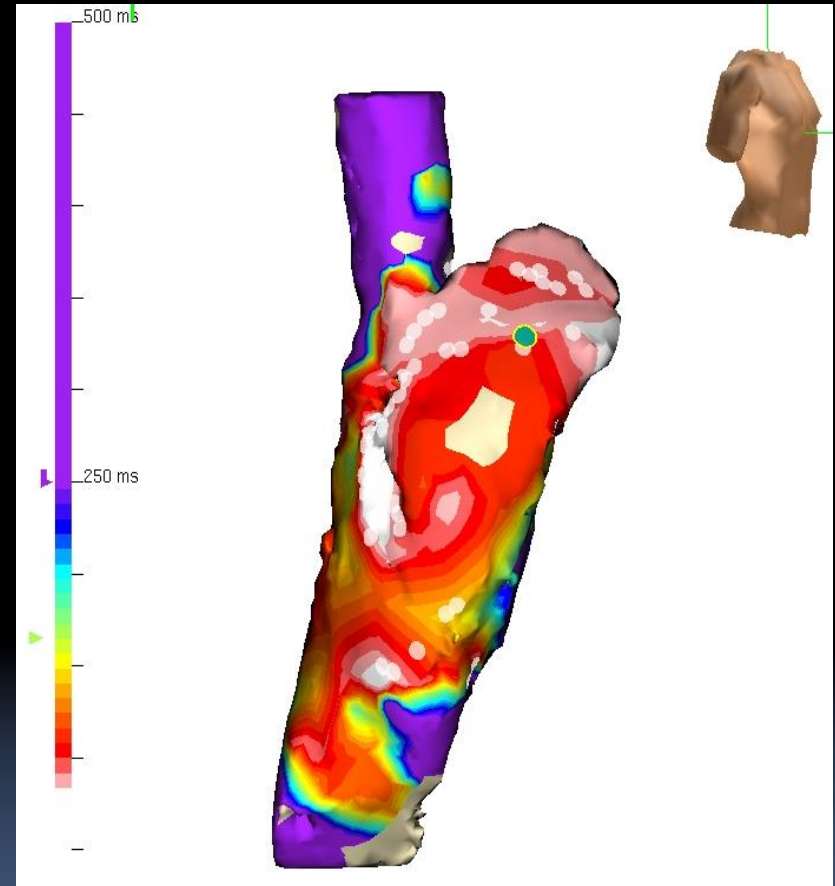
RA CFAE Map



RA CFAE ABL

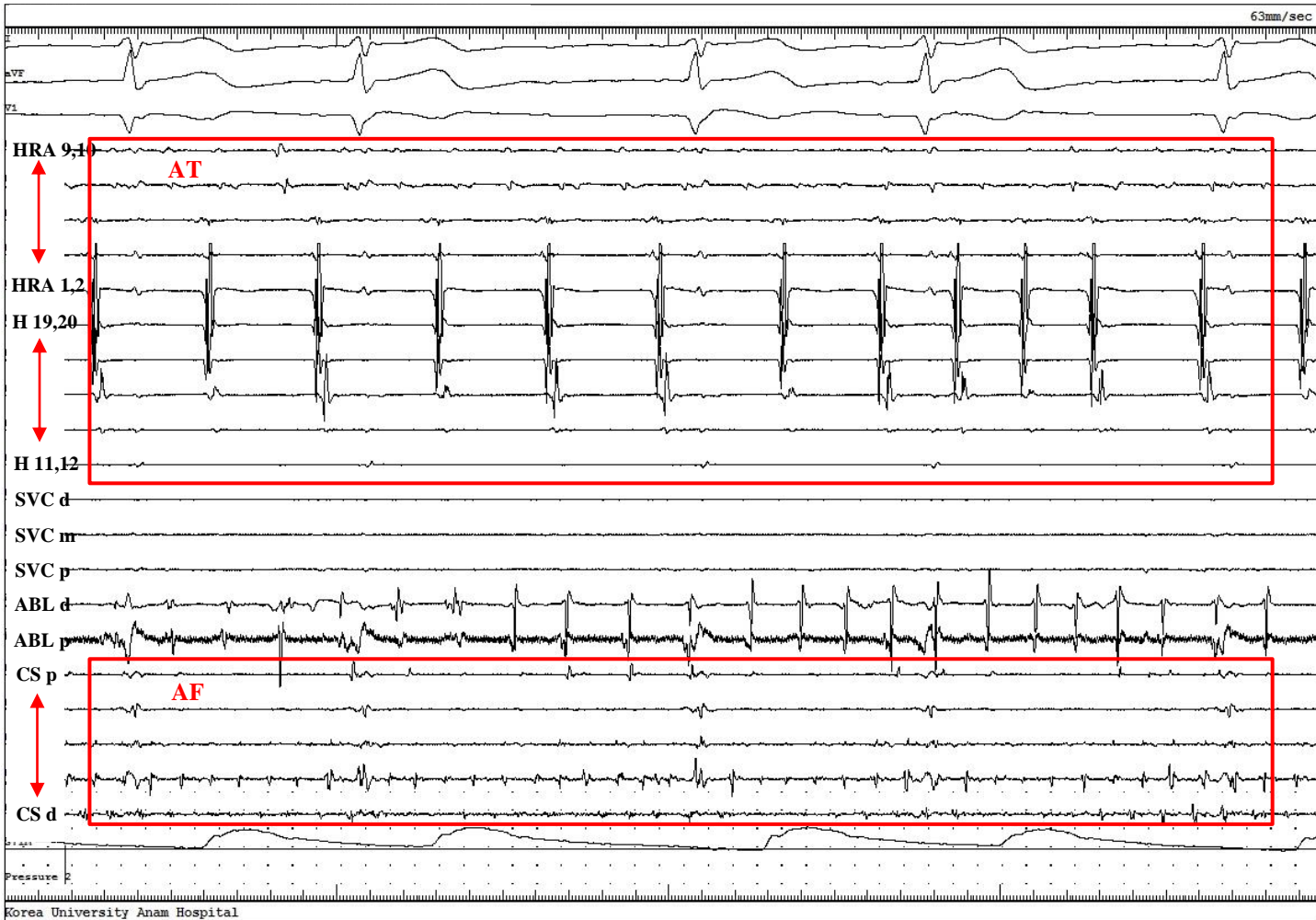


During ABL

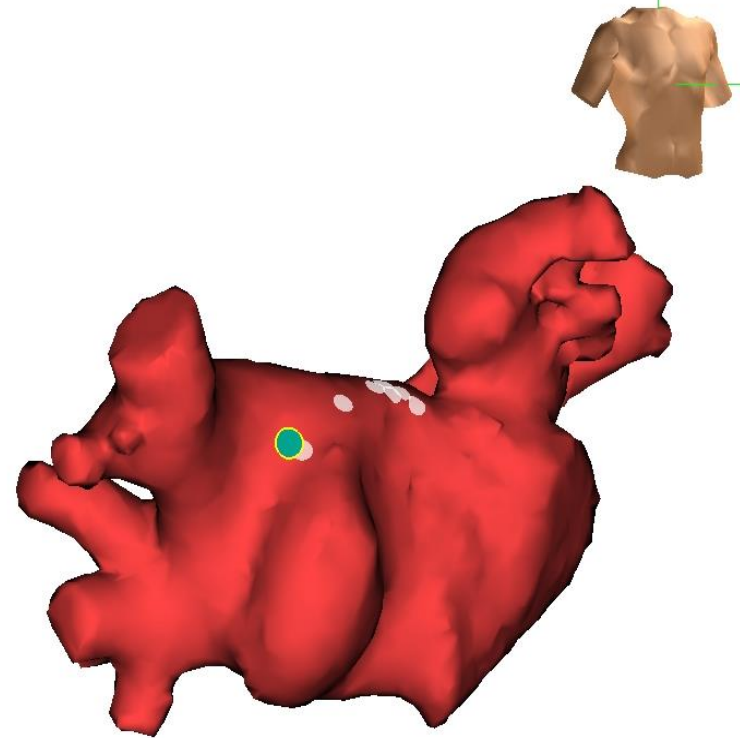
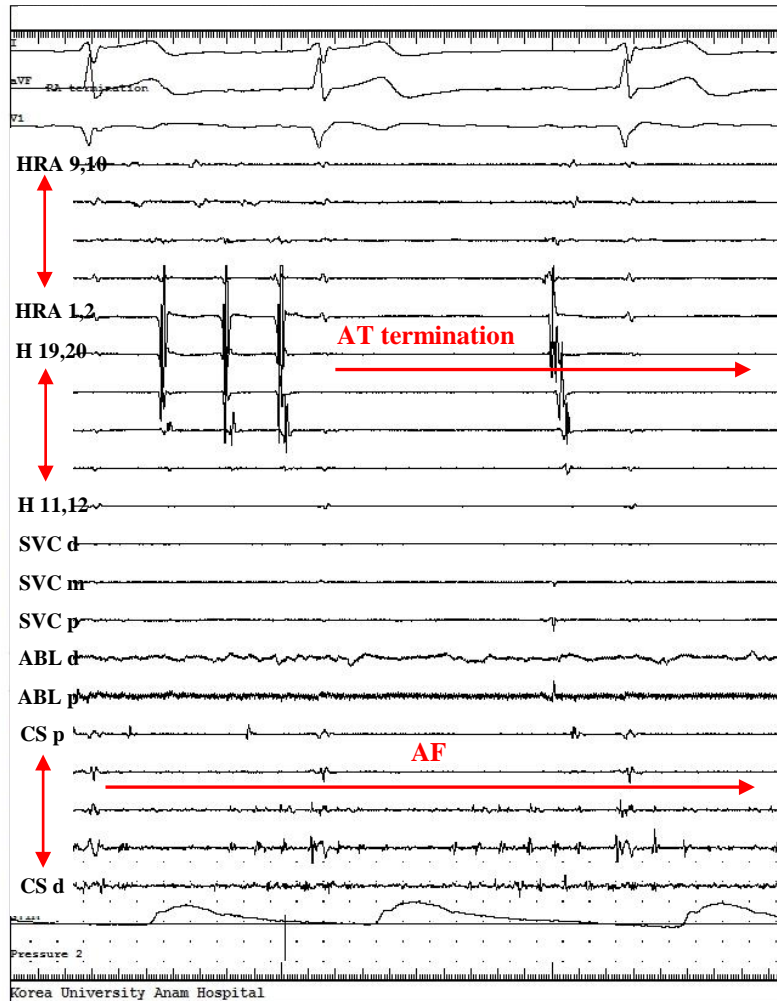


Width : 24ms, refractory : 49, MEAH : 6sec, Sensitivity : 0.1mV, detect : - dv/dt, White : under 80ms, Red to blue : 80~250ms, Purple : over 250ms

Post RA CFAE Ablation

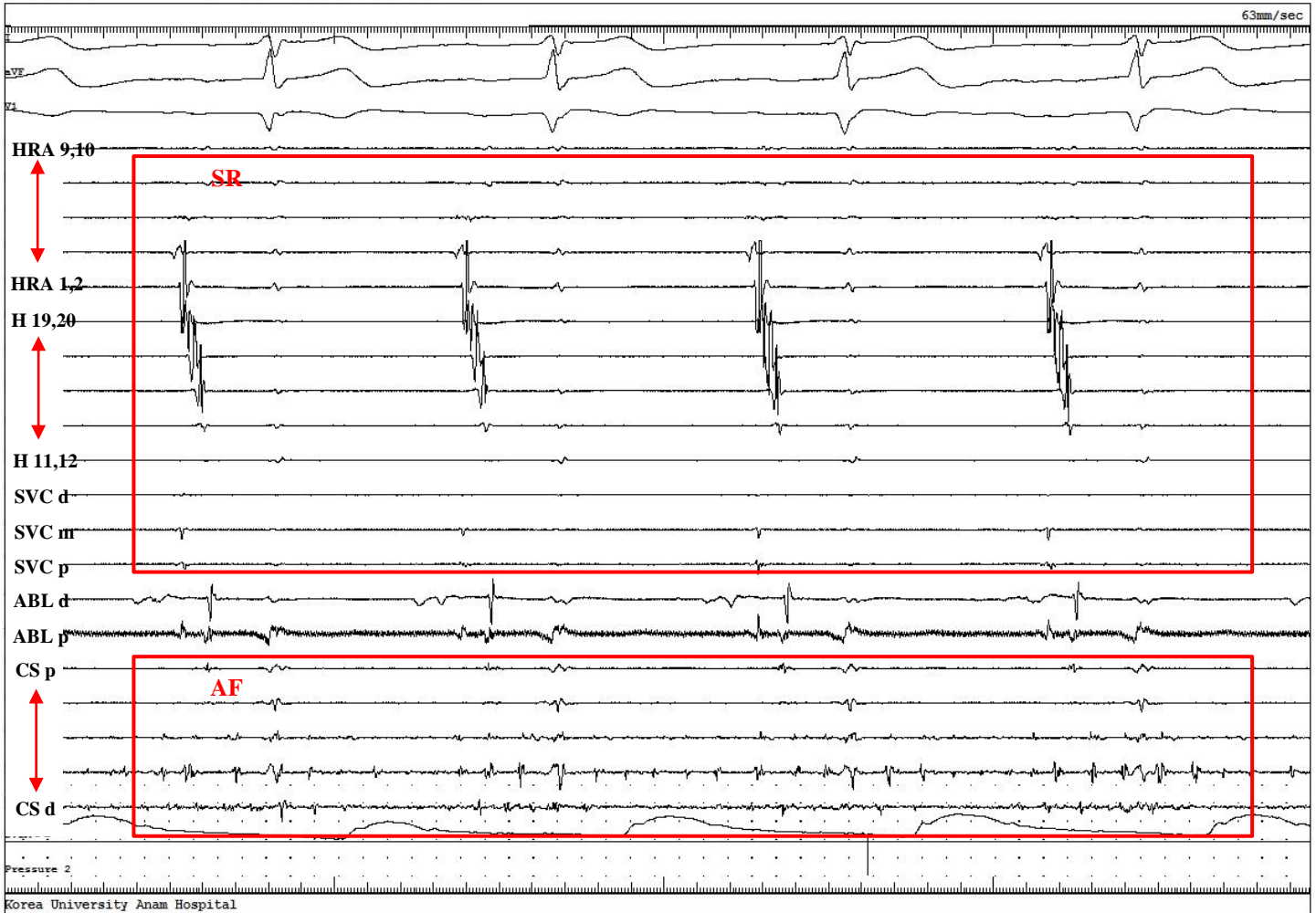


LA CFAE ABL

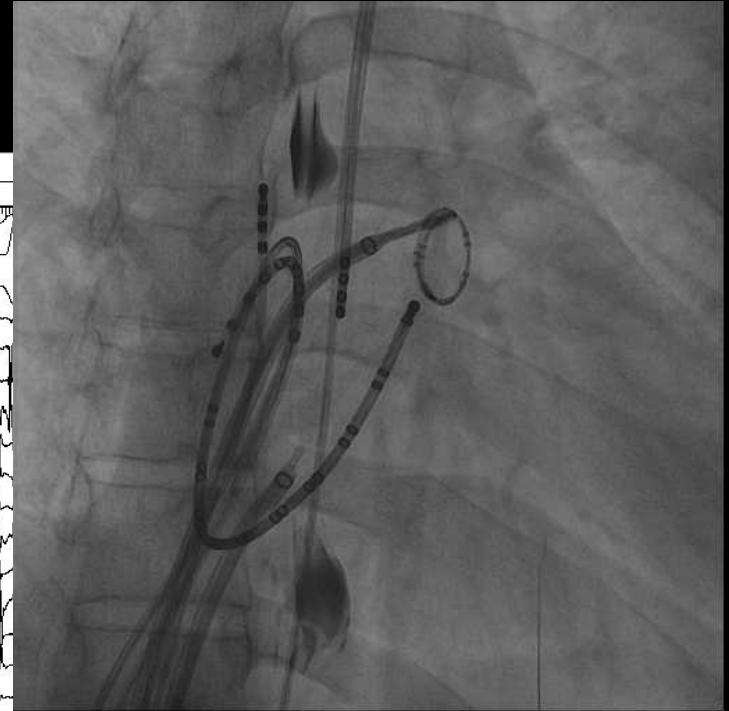
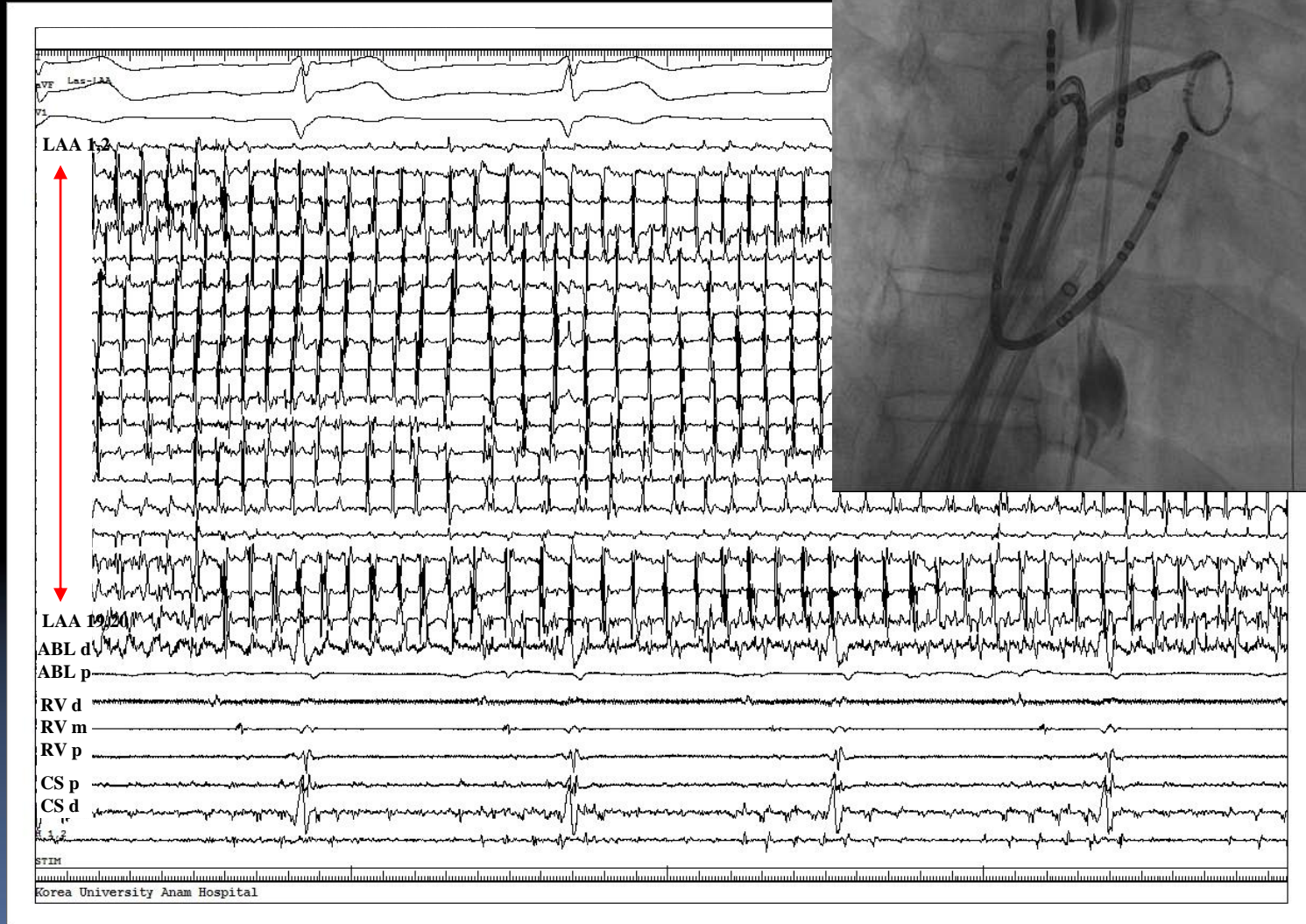


Bachman's bundle Ablation

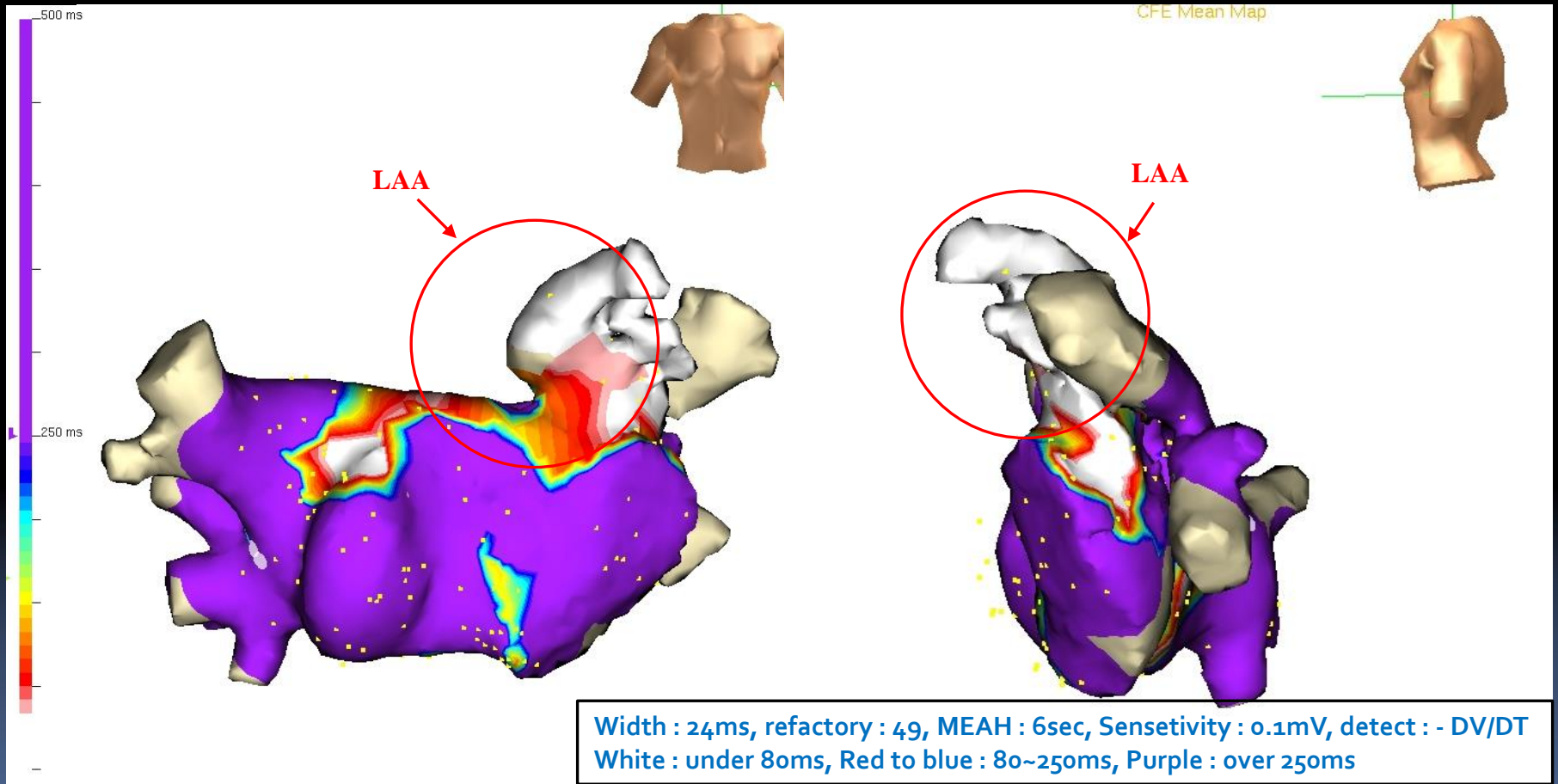
RA-SR / LA-AF



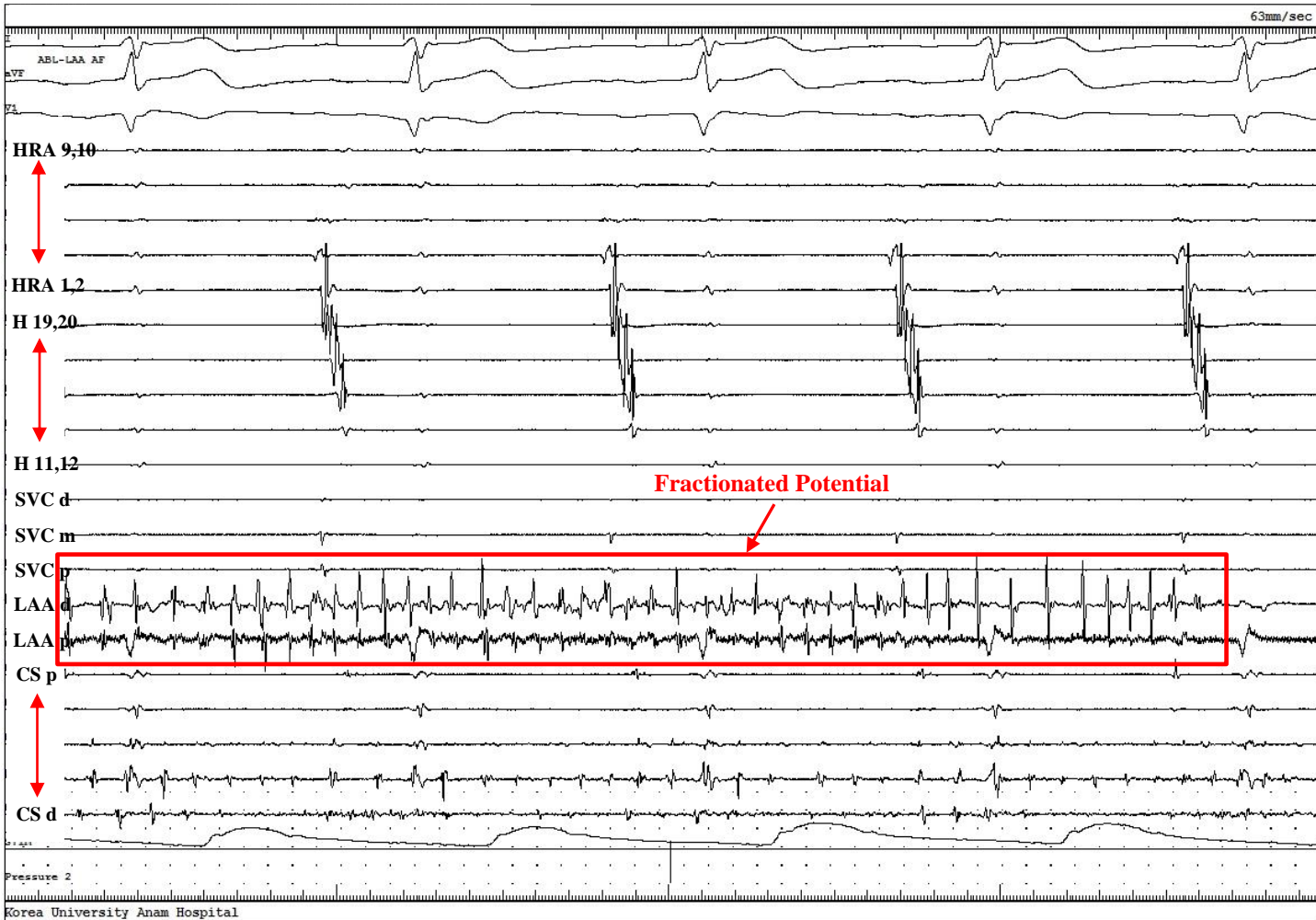
LA Appendage - AF



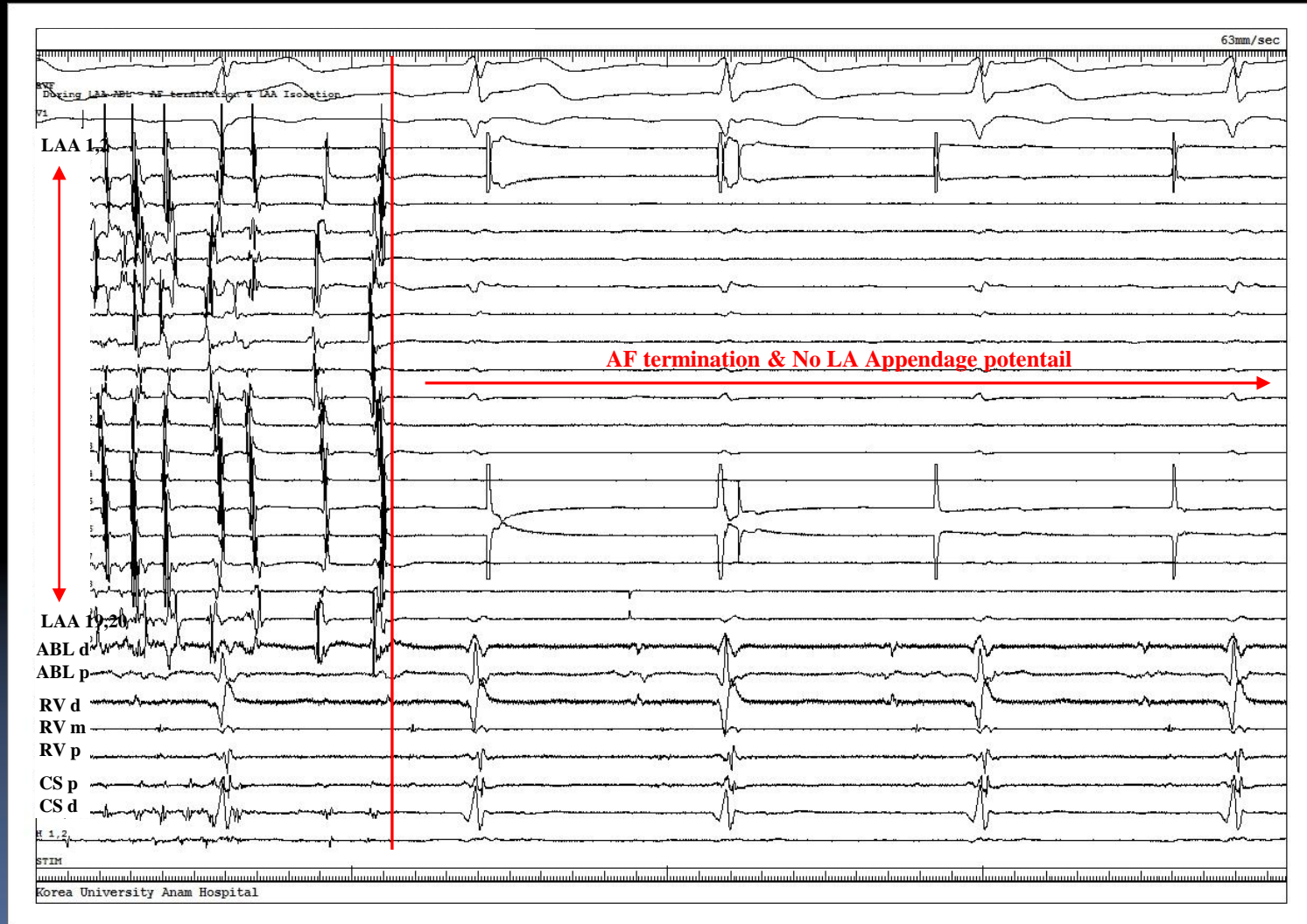
NAVX – LA CFAE Map



LA Appendage Potential



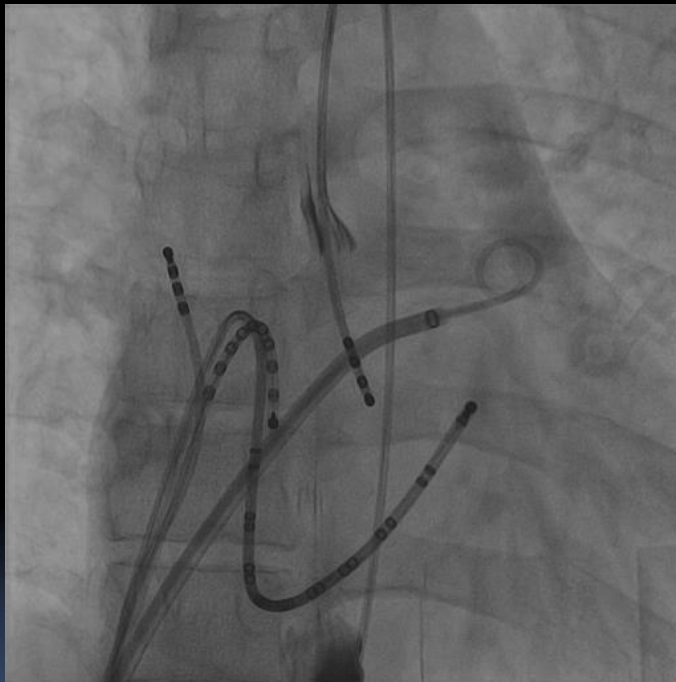
LA Appendage CFAE ABL



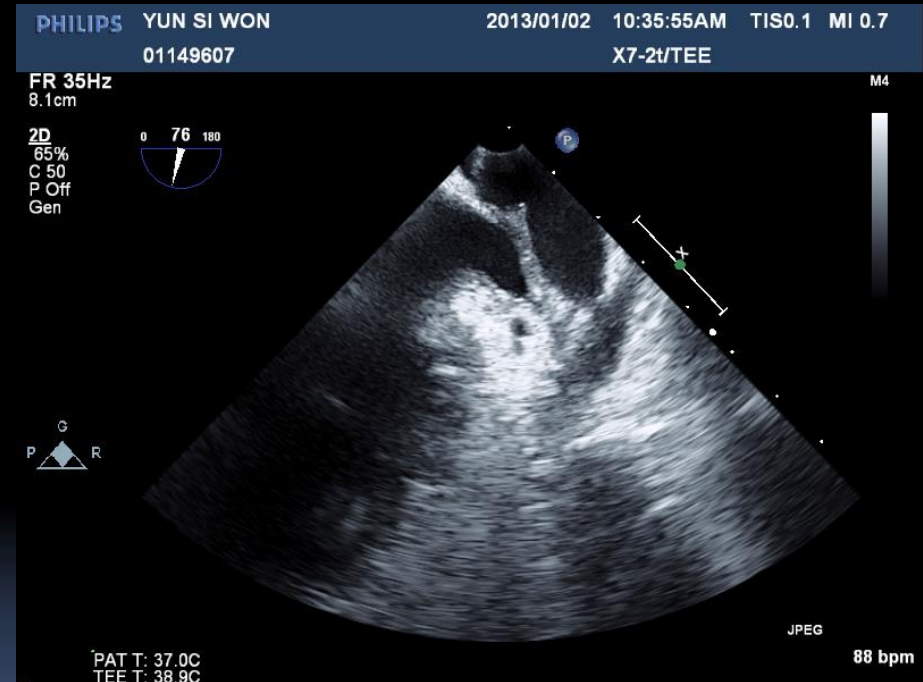
Post ABL SR



Evaluation for LAA contractility



Post LA appendage Angiogram



TEE after 3days

Case II



1st procedure

- ❑ 65years old, Male
- ❑ CC) Palpitaion (Since 2001)
- ❑ Brief Hx)
 - 2010 . 5 OP for stomach cancer → AF
- ❑ Ablation Summary (2011)
 - Circumferential antral ablation with electrical isolation of 4 PVs including left carina.
 - Roof line ablation.
 - During ablation, AFL was terminated.
 - CTI ablation with bidirectional block
 - Hemopericardium and cardiac tamponade requiring emergent pericardiocentesis



2nd procedure

Brief Hx)

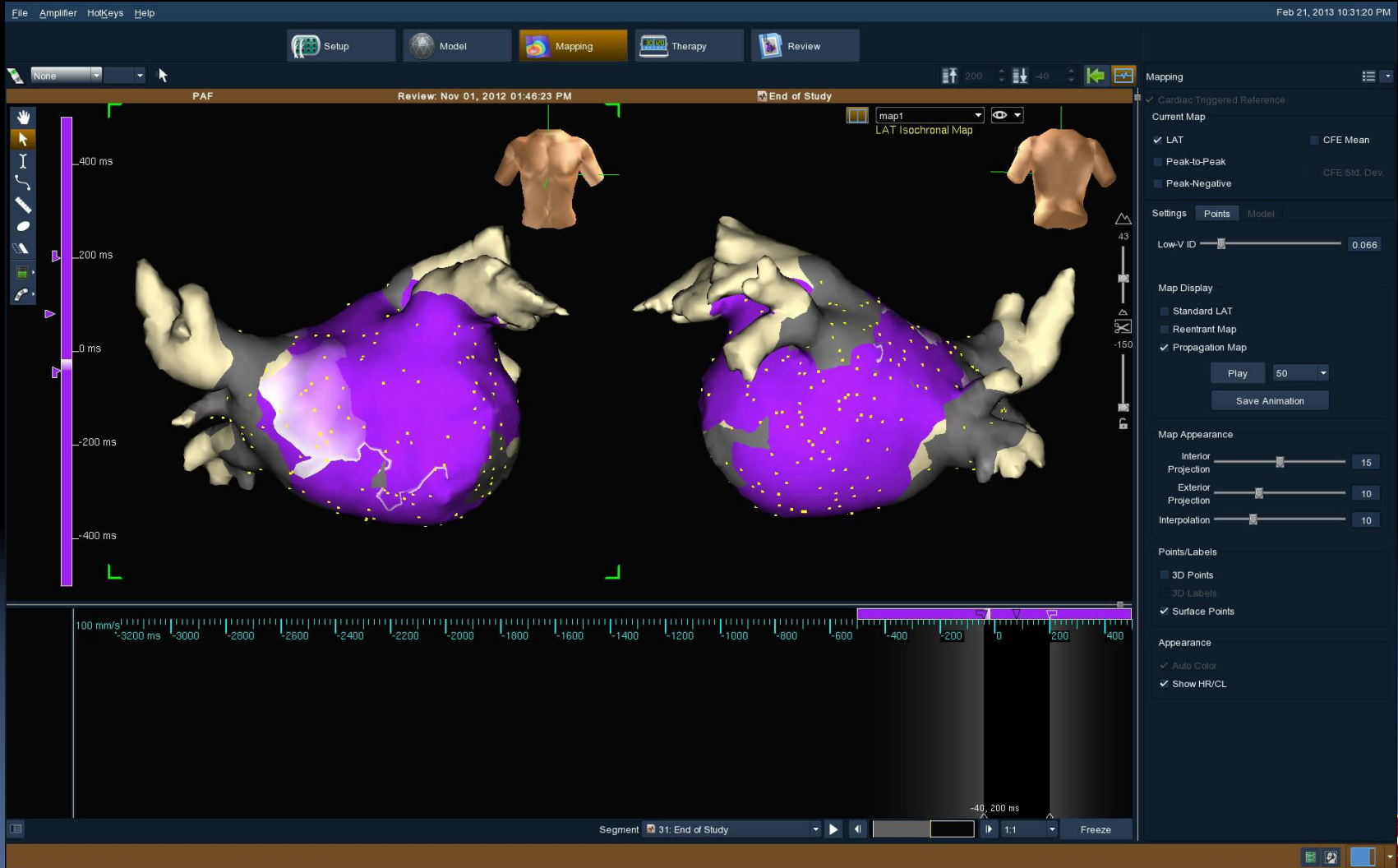
- 2011. 11. 24 Cardioversion → NSR
 - ⇒ Medication : flecainide, bisoprolol, ARB, wafarin
- Frequent episode of AF / AFL : CV & AAD refractory

□ Ablation Summary (2012 66yr)

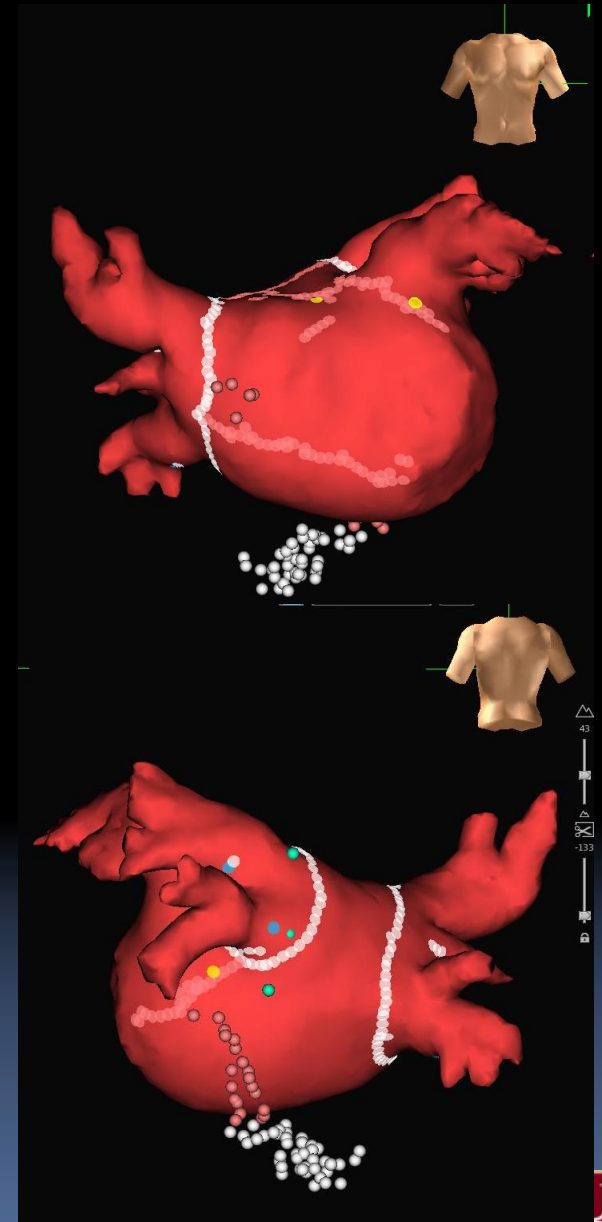
- 4 pulmonary vein showed reconnected PV potential.
- IRAF was evaluated with isoproterenol 10ug/min and IRAF was shown from LSPV and changed to AT.
- AF ablation was started under atrial tachycardia.
- Circumferential antral ablation with electrical isolation of PVs.
- AT: ablation at left septal line.



○ LAT mapping was performed which revealed mitral isthmus dependent AT.



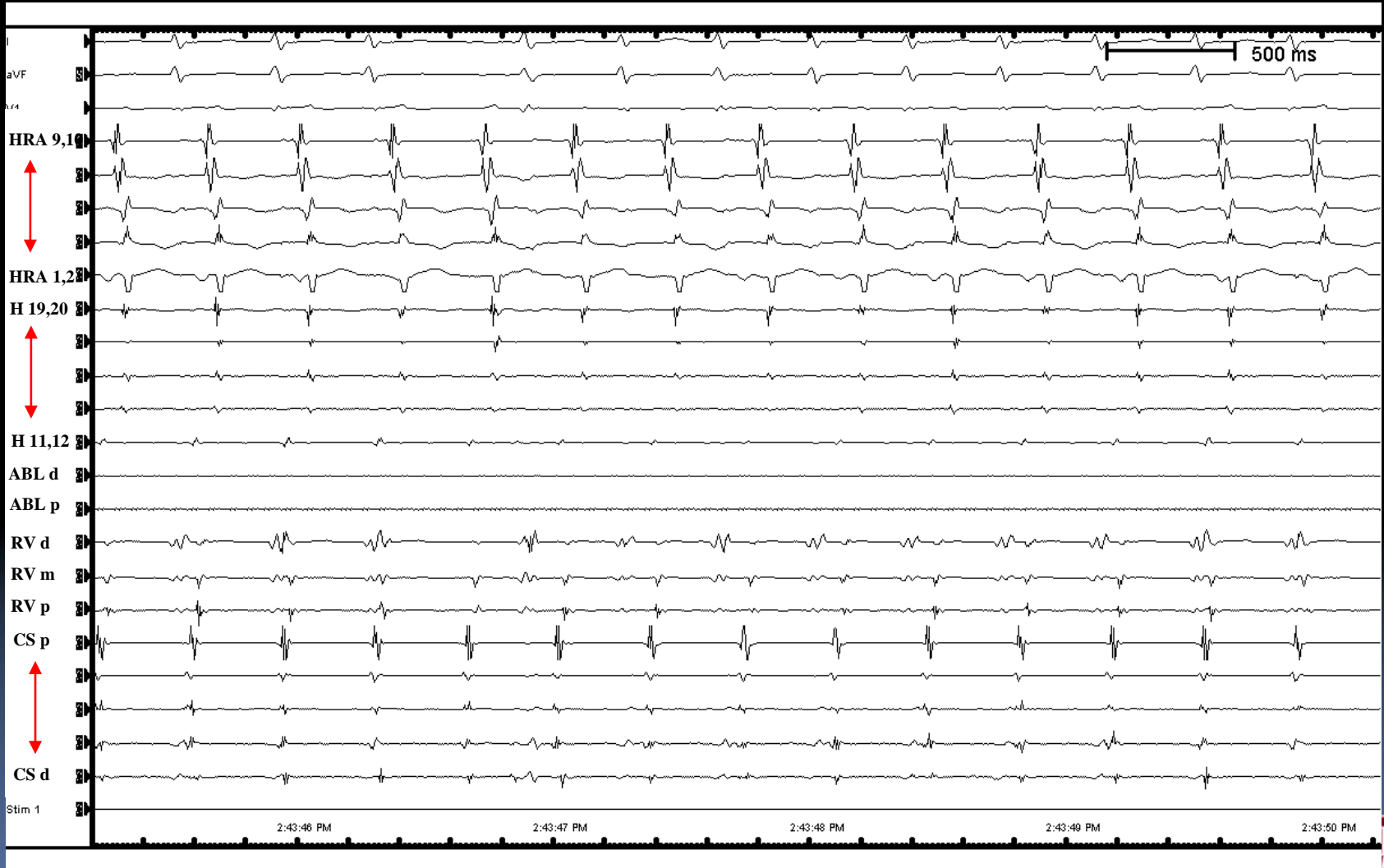
- PMI and AT terminated.
- Induced AT: Ablation at left low anteroseptum, CTI, inside CS, left anterior line, right septal line, roof (AT terminated)
- CTI ablation with incomplete bidirectional block
- LAA potential was delayed.
- Induction test was performed and sustained AF or AT were not induced.



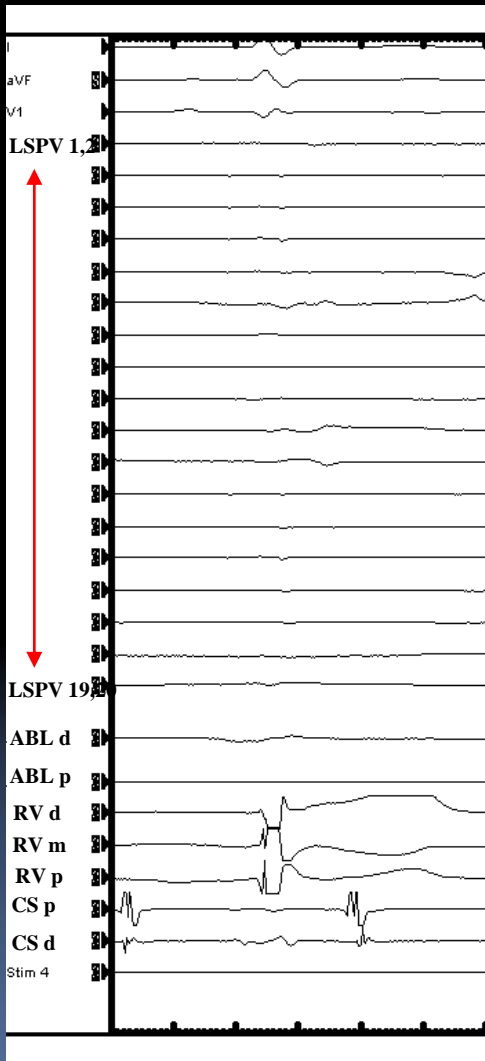
3rd procedure



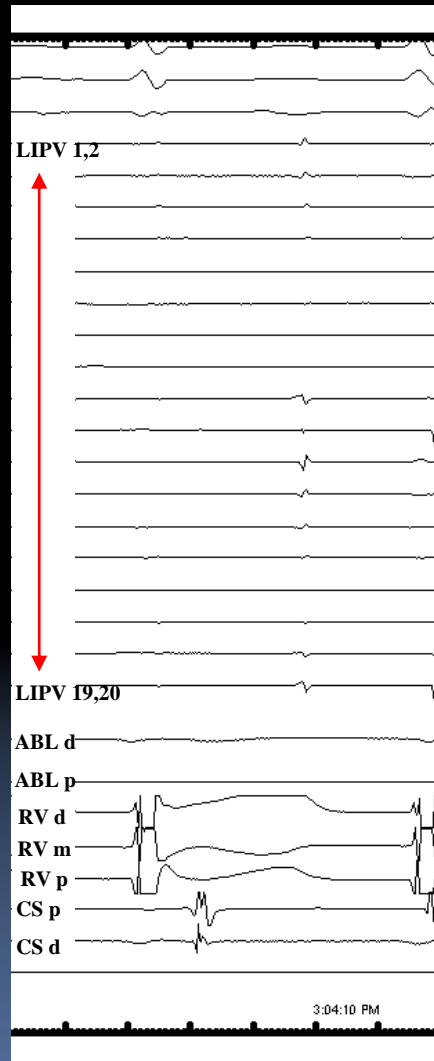
Baseline AT(TCL : 360ms)



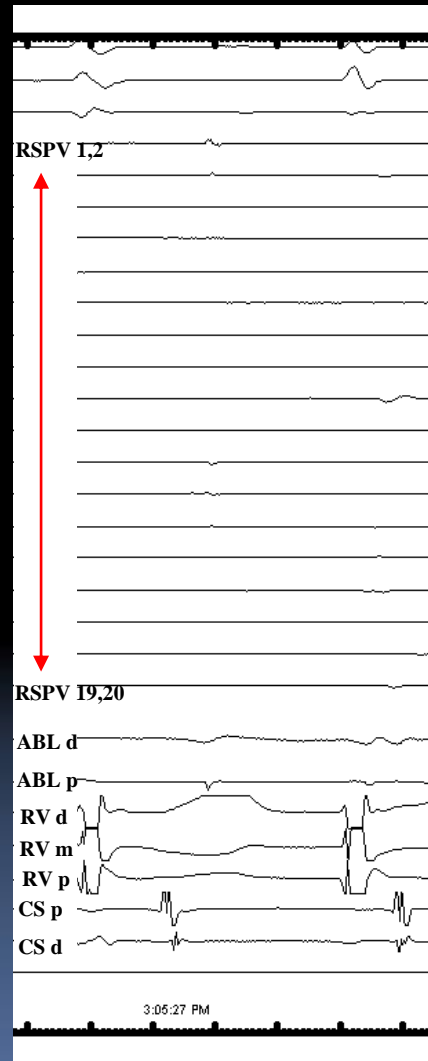
PV Potentials



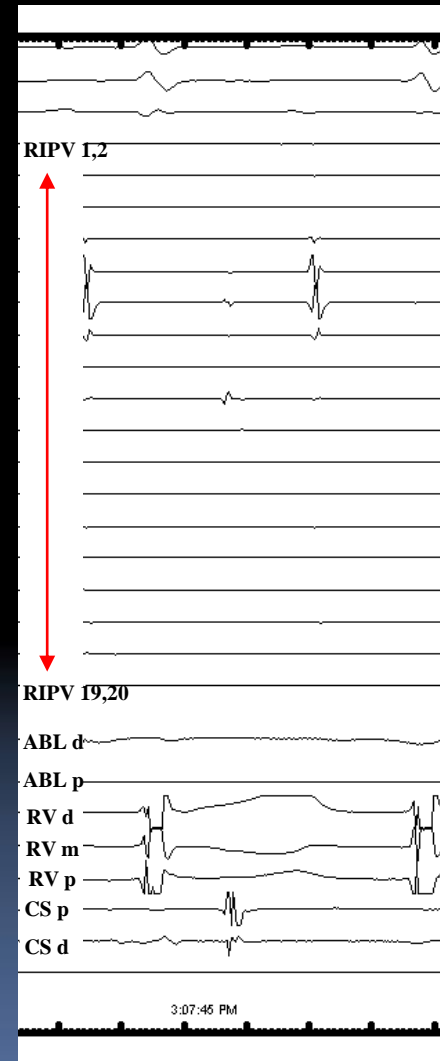
LSPV PVP(-)



LIPV PVP(-)



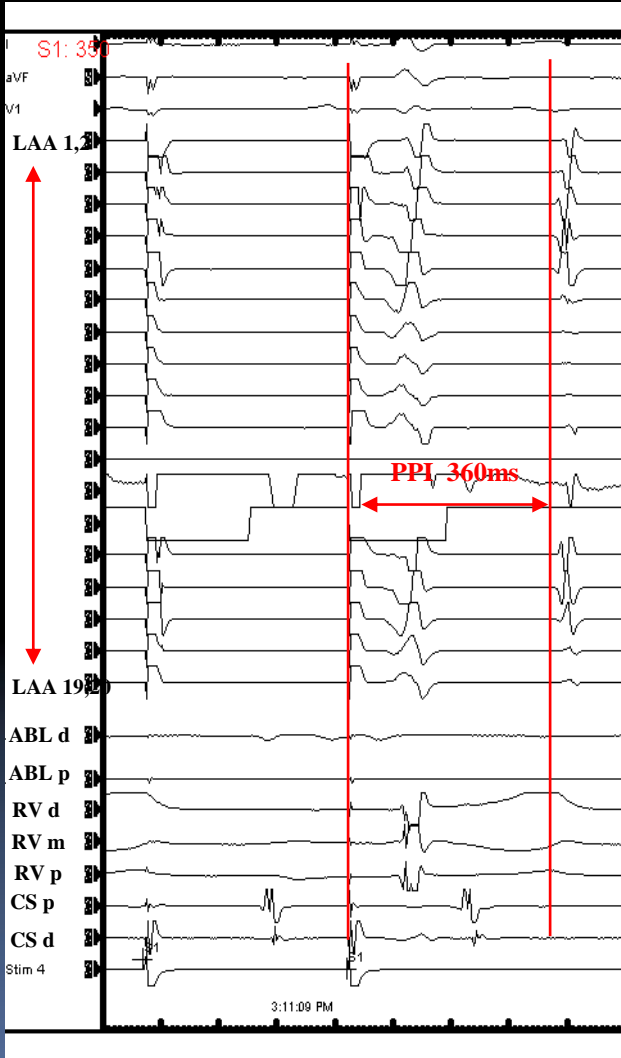
RSPV PVP(-)



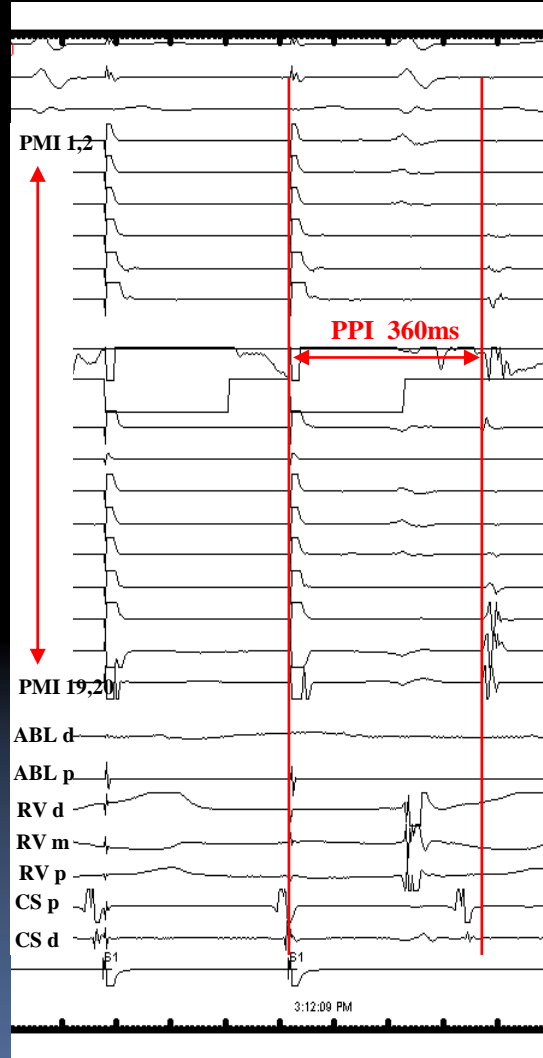
RIPV PVP(-)



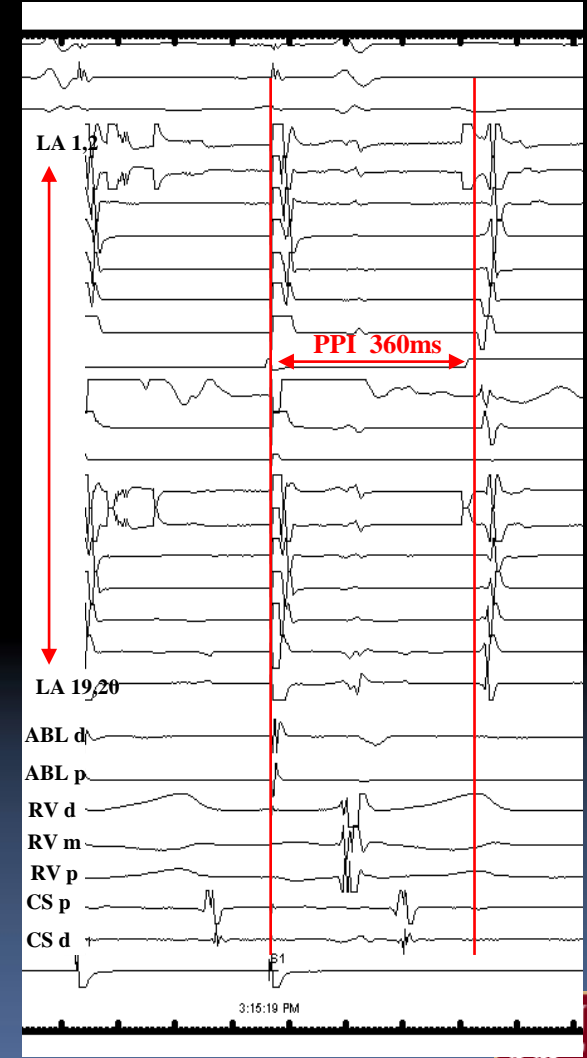
Entrainment Mapping



LAA base



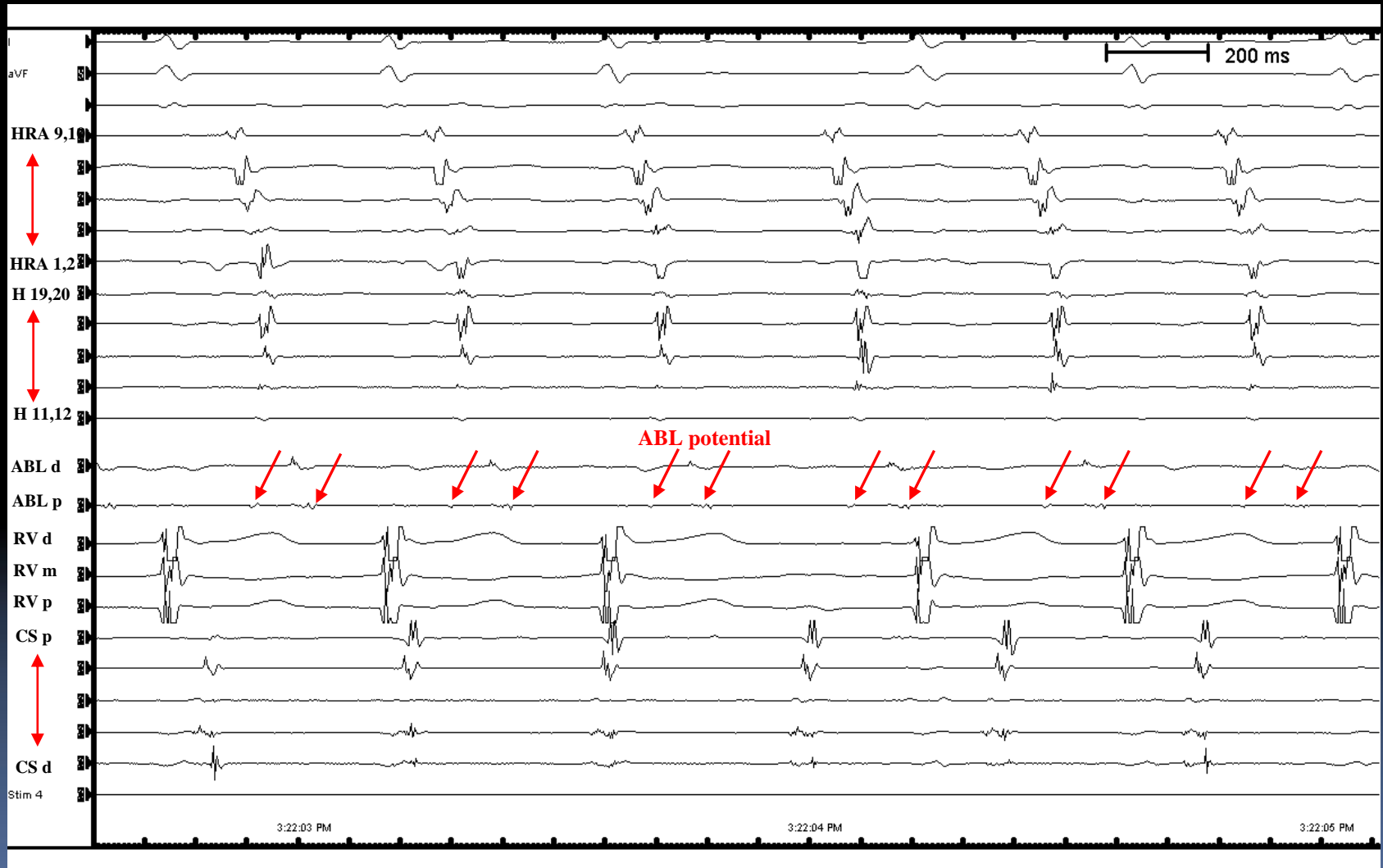
PMI



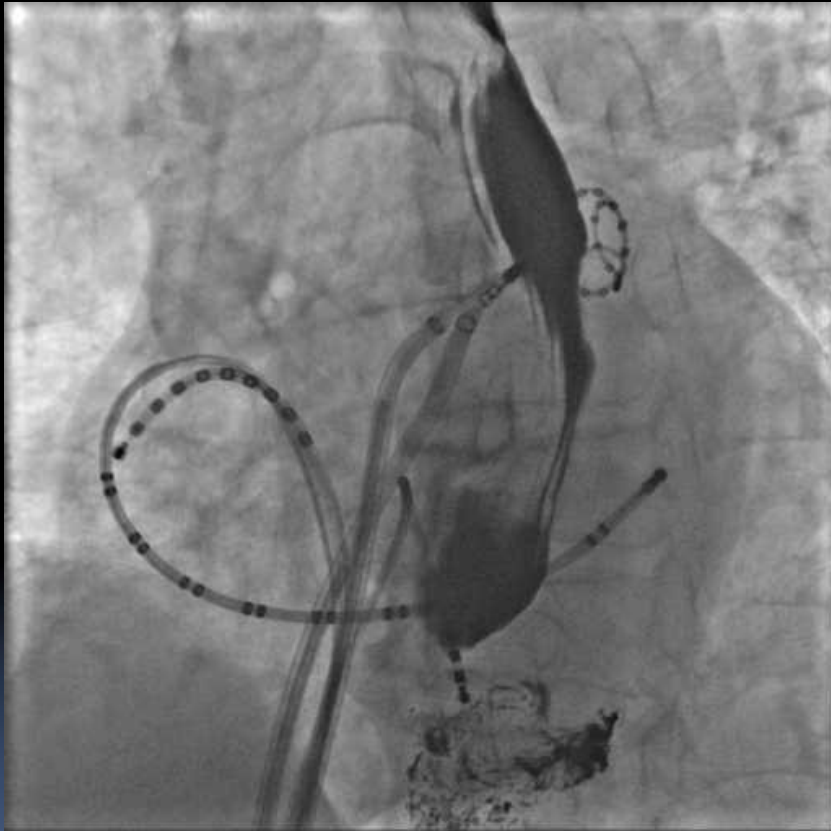
LA Ant wall



ABL site – LA Appendage Base



ABL Site – LA Appendage Base

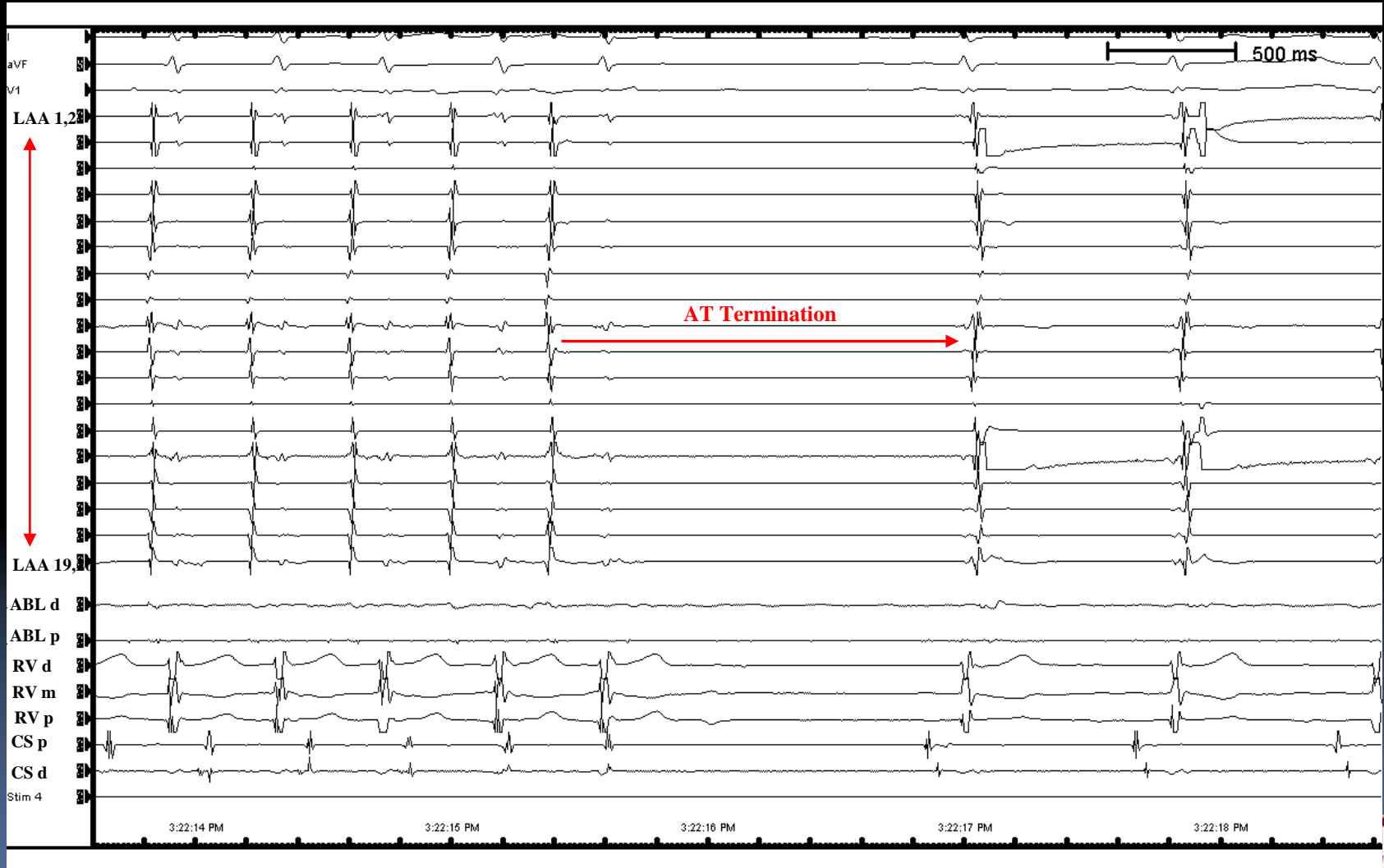


LAO 35°

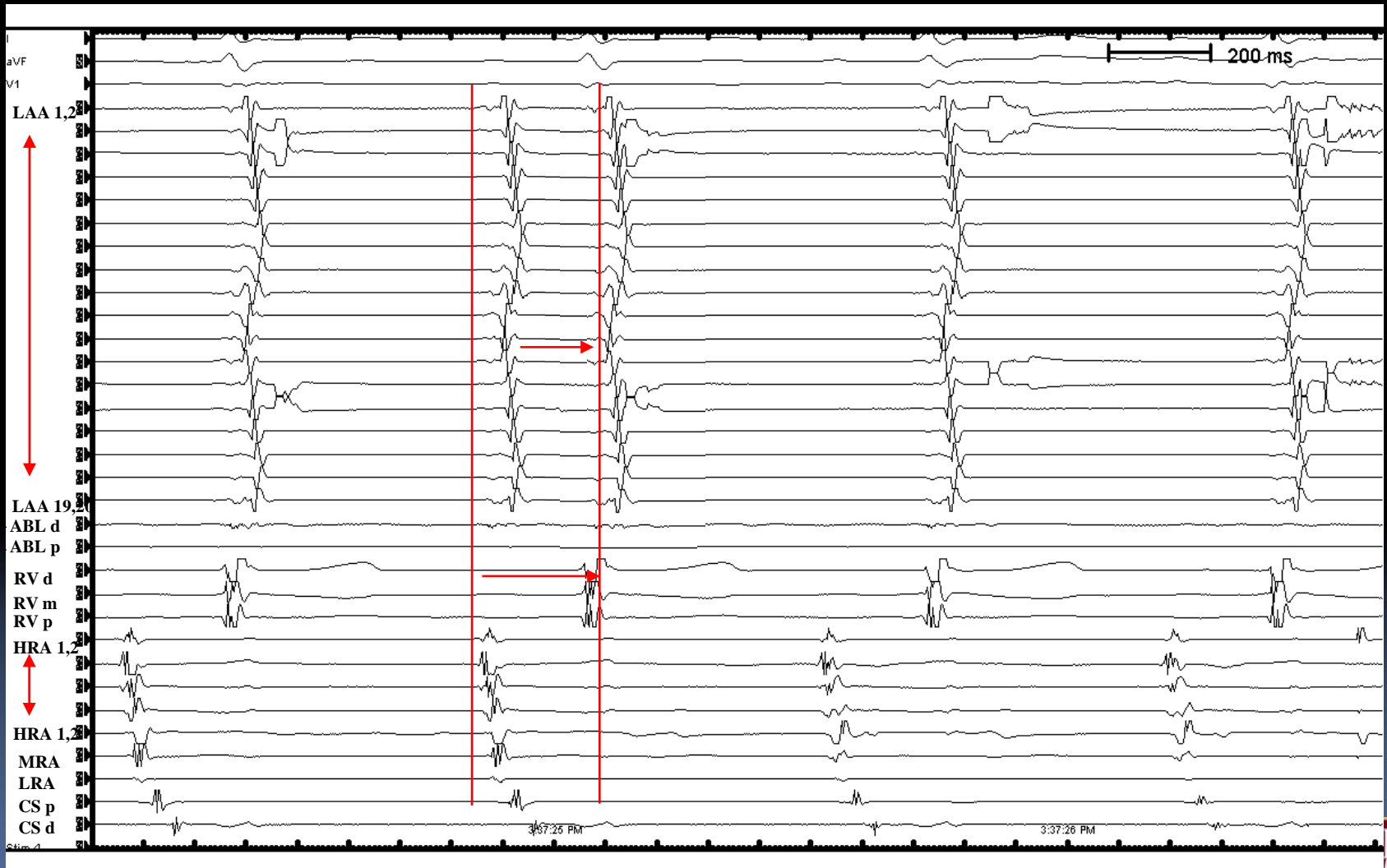


RAO 35°

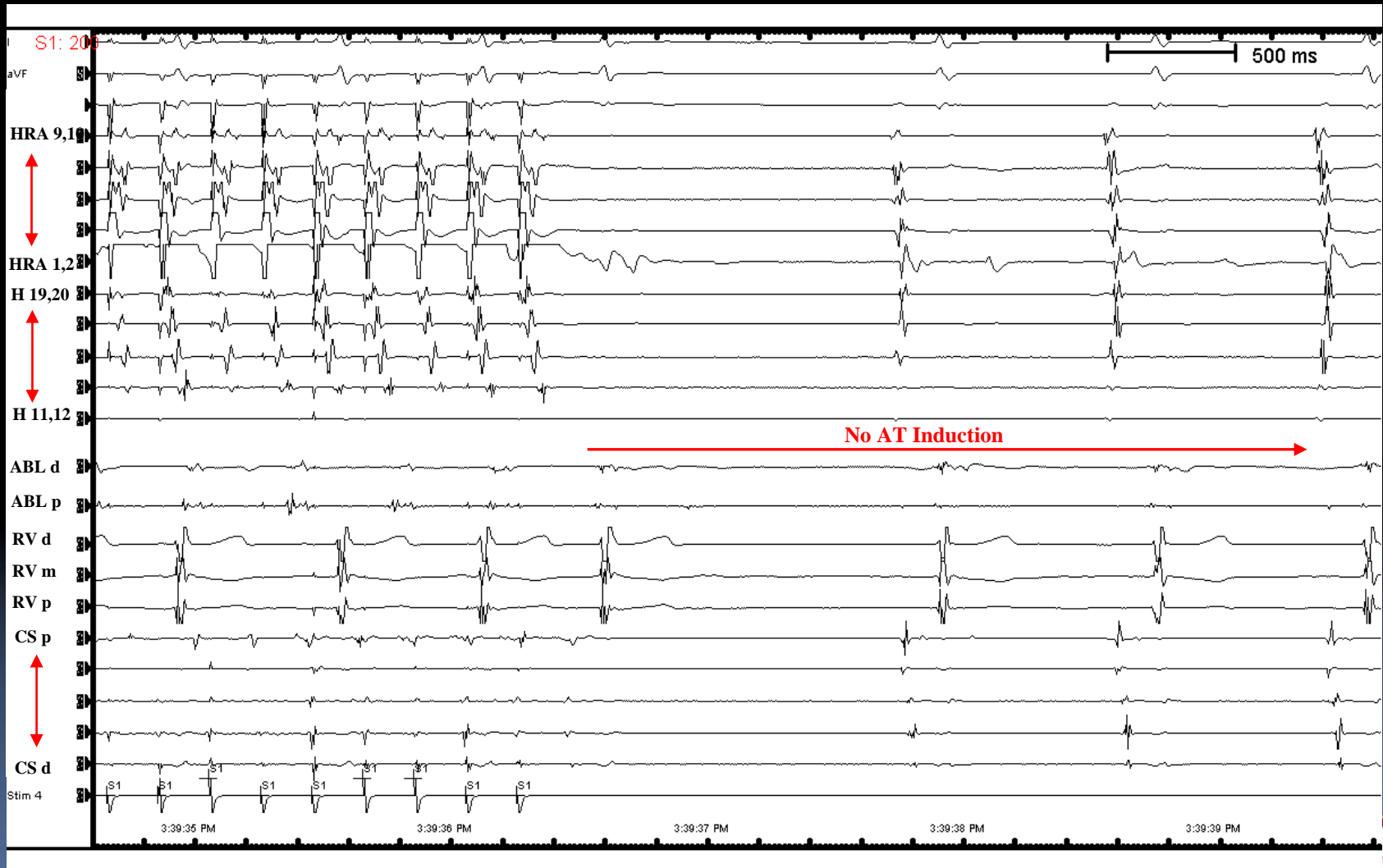
During LA Appendage base ABL



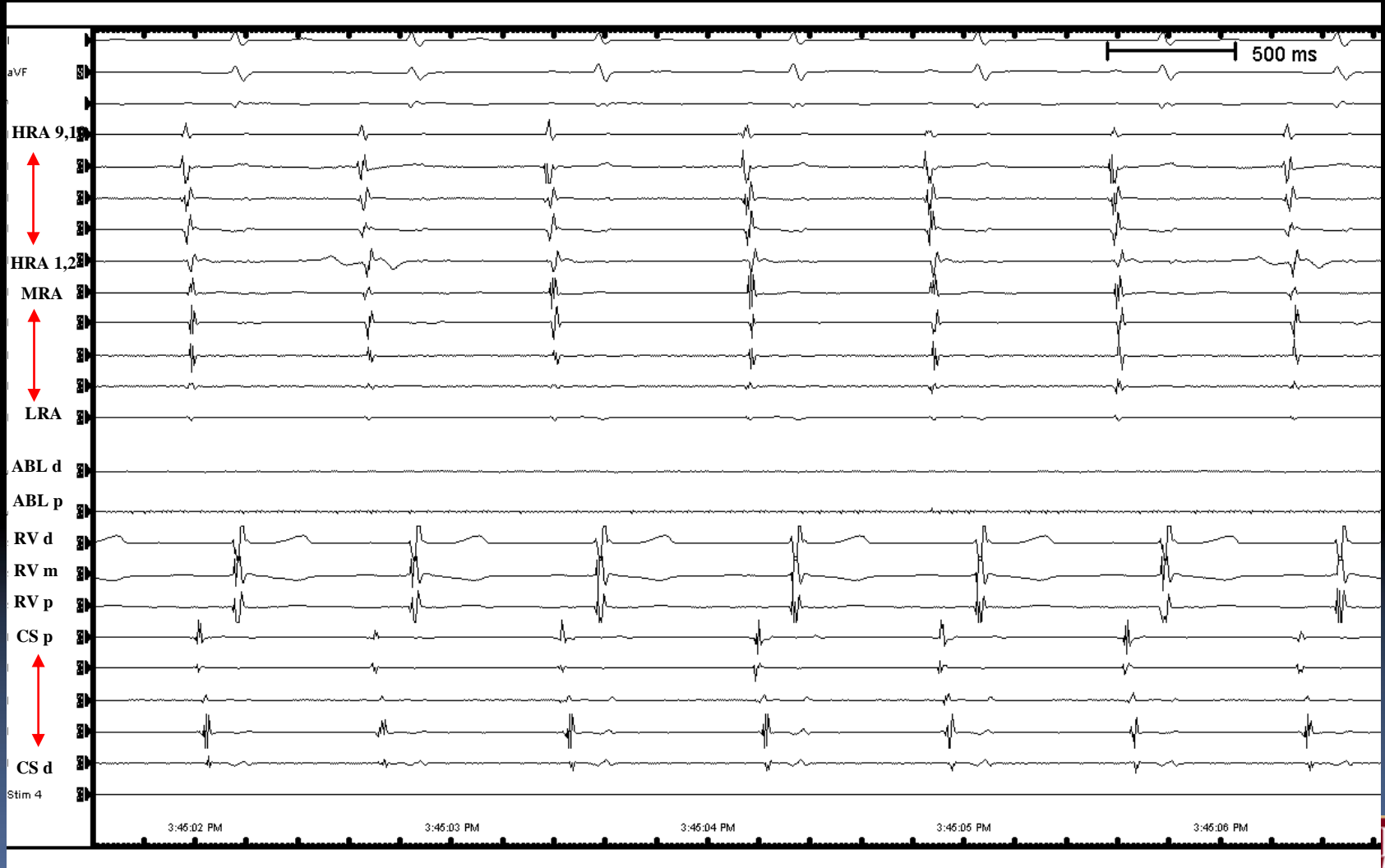
Post ABL LA Appendage



Inducibility Test



Post ABL SR



LA Appendage Angiogram



Baseline



Post

Introduction

- **Radiofrequency catheter ablation for atrial tachycardia originating from the left atrial appendage**

- Kato M et al. *J Interv Card Electrophysiol* 2007;19:45-48

- **Left atrial appendage: an underrecognized trigger site of atrial fibrillation.**

- Di Biase L. et al. *Circulation* 2010;122:109-118

- **Atrial Tachycardia After Atrial Fibrillation Ablation : What Is the Mechanism?**

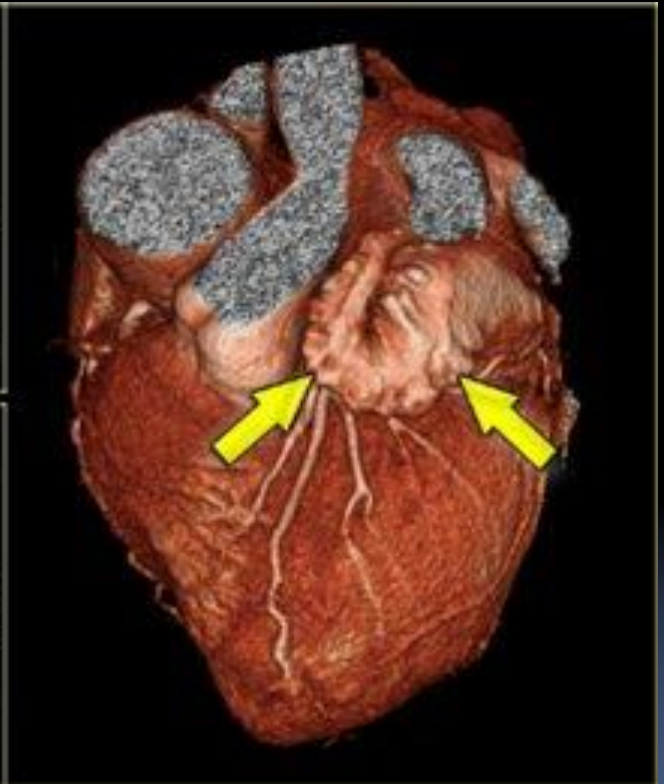
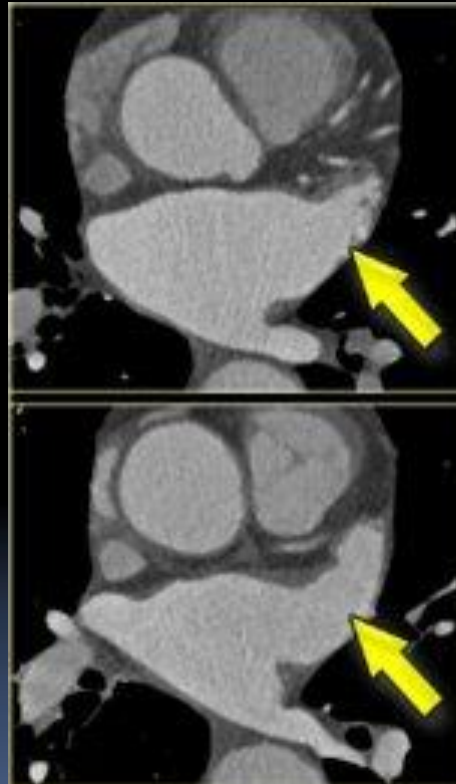
- Shinsuke Miyazaki. et al. *J cardiovasc Electrophysiol*, Vol. 23, pp. 791-793, July 2012

- **Disconnection of the left atrial appendage for elimination of foci maintaining atrial fibrillation**

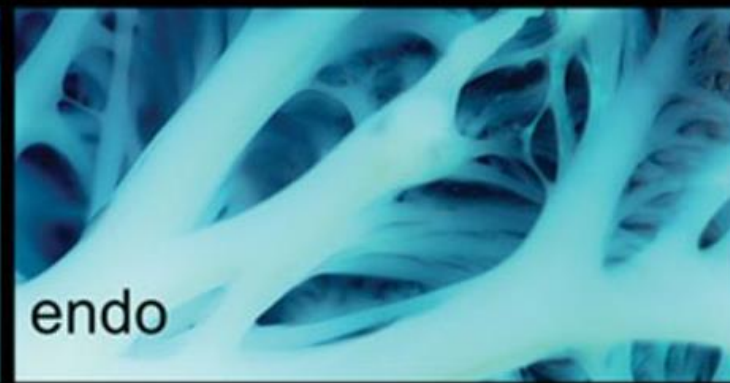
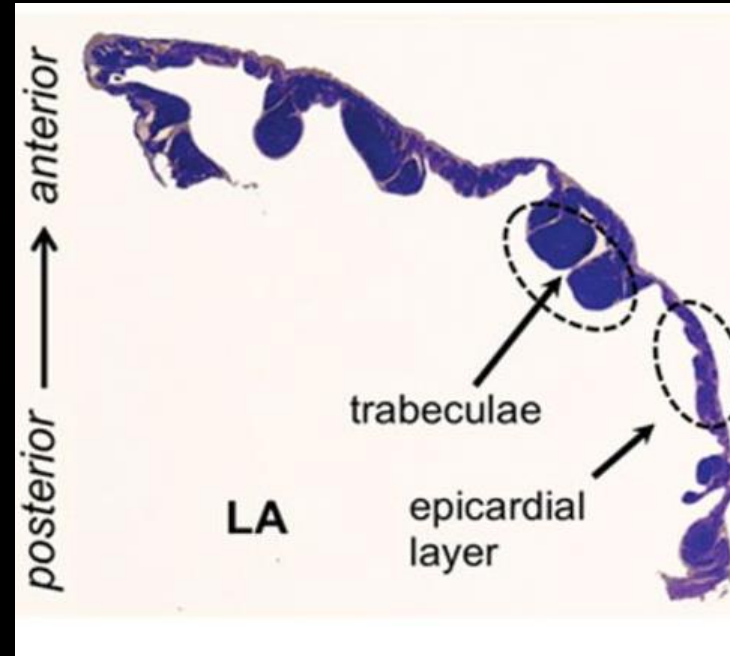
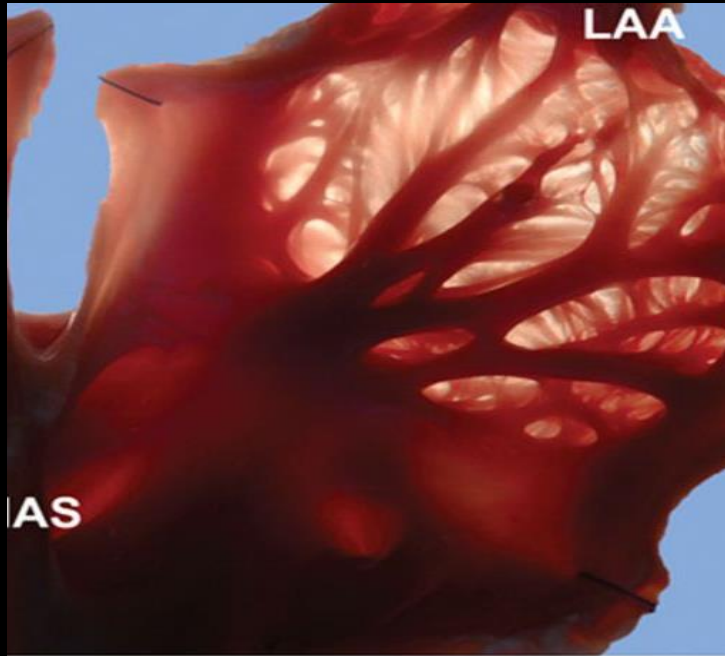
- Haissaguerre M. et al. *Circulation* 2006;113:616-625



Anatomy of Left Atrial Appendage



Anatomy of Left Atrial Appendage



Localized reentry within the left atrial appendage: arrhythmogenic role in patients undergoing ablation of persistent atrial fibrillation

Mélèze Hocini, MD, Ashok J. Shah, MD, Isabelle Nault, MD, Prashanthan Sanders, MBBS, PhD, Matthew Wright, MBBS, PhD, Sanjiv M. Narayan, MD, FACC, Yoshihide Takahashi, MD, Pierre Jaïs, MD, Seiichiro Matsuo, MD, Sébastien Knecht, MD, Frédéric Sacher, MD, Kang-Teng Lim, MD, Jacques Clémenty, MD, Michel Haïssaguerre, MD

From the Hôpital Cardiologique du Haut-Lévêque and the Université Victor Segalen Bordeaux II, Bordeaux, France.

BACKGROUND: Left atrial appendage (LAA) is implicated in maintenance of atrial fibrillation (AF) and atrial tachycardia (AT) associated with persistent AF (PsAF) ablation, although little is known about the incidence and mechanism of LAA AT.

OBJECTIVE: The purpose of this study was to characterize LAA ATs associated with PsAF ablation.

METHODS: In 74 consecutive patients undergoing stepwise PsAF ablation, 142 ATs were encountered during index and repeat procedures. Out of 78 focal-source ATs diagnosed by activation and entrainment mapping, 15 (19%) arose from the base of LAA. Using a 20-pole catheter, high-density maps were constructed ($n = 10$; age 57 ± 6 years) to characterize the mechanism of LAA-AT. The LAA orifice was divided into the posterior ridge and anterior-superior and inferior segments to characterize the location of AT.

RESULTS: Fifteen patients with LAA AT had symptomatic PsAF for 17 ± 15 months before ablation. LAA AT (cycle length [CL] 283 ± 30 ms) occurred during the index procedure in four and after 9 ± 7 months in 11 patients. We could map $89\% \pm 8\%$ AT CLs locally with favorable entrainment from within the LAA, which is suggestive of localized reentry with centrifugal atrial activation. ATs were localized to inferior segment ($n = 4$), anterior-superior

segment ($n = 5$), and posterior ridge ($n = 6$) with 1:1 conduction to the atria. Ablation targeting long fractionated or mid-diastolic electrogram within the LAA resulted in tachycardia termination. Postablation, selective contrast radiography demonstrated atrial synchronous LAA contraction in all but one patient. At 18 ± 7 months, 13/15 (87%) patients remained in sinus rhythm without antiarrhythmic drugs.

CONCLUSION: LAA is an important source of localized reentrant AT in patients with PsAF at index and repeat ablation procedures. Ablation targeting the site with long fractionated or mid-diastolic LAA electrogram is highly effective in acute and medium-term elimination of the arrhythmia.

KEYWORDS: Left atrial appendage; Atrial tachycardia; Localized reentry; Persistent atrial fibrillation; Catheter ablation

ABBREVIATIONS: AF = atrial fibrillation; AT = atrial tachycardia; CL = cycle length; LA = left atrium/atrial; LAA = left atrial appendage; PsAF = persistent atrial fibrillation; RF = radiofrequency; LV = left ventricular

(Heart Rhythm 2011;8:1853–1861) © 2011 Published by Elsevier Inc. on behalf of Heart Rhythm Society.



Localized Sources Maintaining Atrial Fibrillation Organized by Prior Ablation

Michel Haïssaguerre, MD; Méléze Hocini, MD; Prashanthan Sanders, MBBS, PhD; Yoshihide Takahashi, MD; Martin Rotter, MD; Frederic Sacher, MD; Thomas Rostock, MD; Li-Fern Hsu, MBBS; Anders Jonsson, MD; Mark D. O'Neill, MBChB, DPhil; Pierre Bordachar, MD; Sylvain Reuter, MD; Raymond Roudaut, MD; Jacques Clémenty, MD; Pierre Jaïs, MD

Background—Endocardial mapping of localized sources driving atrial fibrillation (AF) in humans has not been reported.

Methods and Results—Fifty patients with AF organized by prior pulmonary vein and linear ablation were studied. AF was considered organized if mapping during AF showed irregular but discrete atrial complexes exhibiting consistent activation sequences for >75% of the time using a 20-pole catheter with 5 radiating spines covering 3.5-cm diameter or sequential conventional mapping. A site or region centrifugally activating the remaining atrial tissue defined a source. During AF with a cycle length of 211 ± 32 ms, activation mapping identified 1 to 3 sources at the origin of atrial wavefronts in 38 patients (76%) predominantly in the left atrium, including the coronary sinus region. Electrograms at the earliest area varied from discrete centrifugal activation to an activity spanning 75% to 100% of the cycle length in 42% of cases, the latter indicating complex local conduction or a reentrant circuit. A gradient of cycle length (>20 ms) to the surrounding atrium was observed in 28%. Local radiofrequency ablation prolonged AF cycle length by 28 ± 22 ms and either terminated AF or changed activation sequence to another organized rhythm. In 4 patients, the driving source was isolated, surrounded by the atrium in sinus rhythm, and still firing at high frequency (228 ± 31 ms) either permanently or in bursts.

Conclusions—AF associated with consistent atrial activation sequences after prior ablation emanates mostly from localized sources that can be mapped and ablated. Some sources harbor electrograms suggesting the presence of localized reentry. (*Circulation*. 2006;113:616-625.)

Key Words: ablation ■ arrhythmia ■ atrial flutter ■ mapping ■ tachyarrhythmias



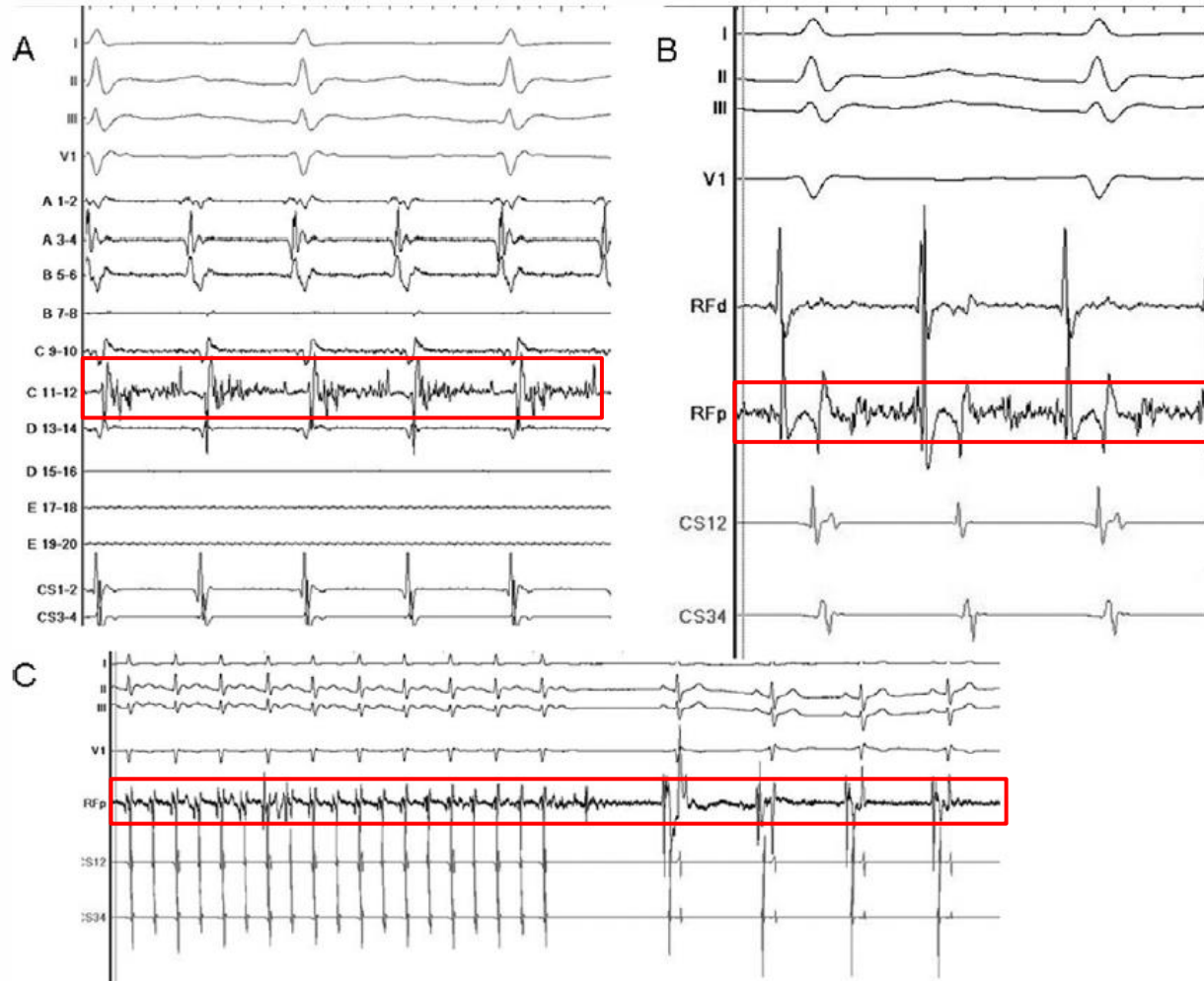
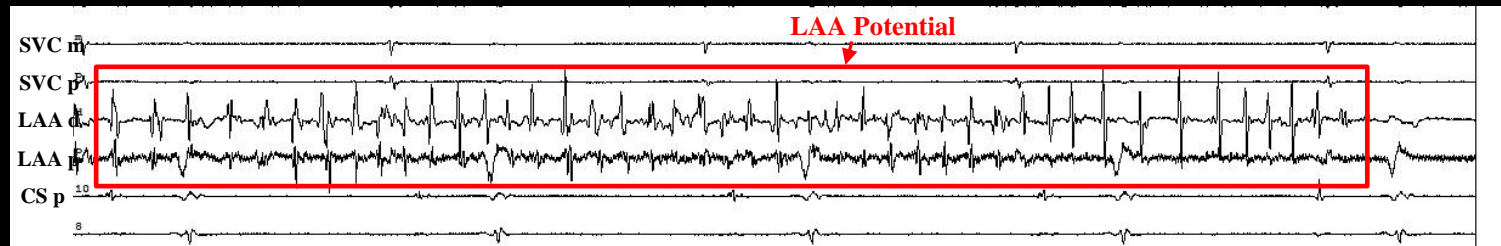


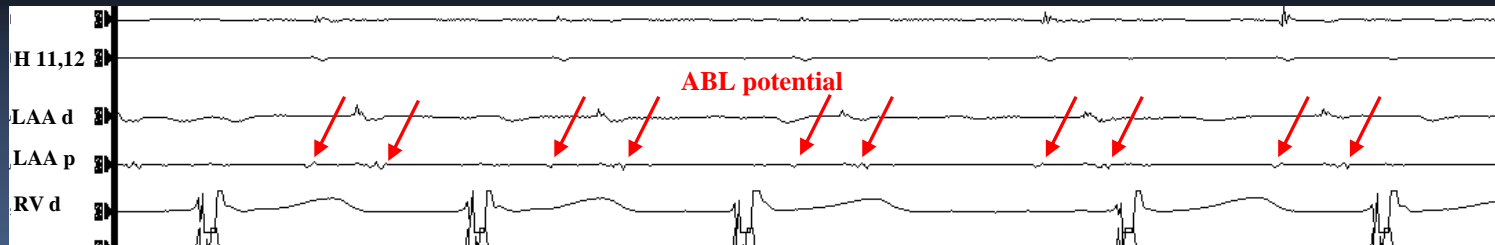
Figure 5 Mapping and ablation of localized reentry from the LAA. A: A long fractionated signal can be seen on bipole C11-12, representing >70% of the tachycardia CL. The ablation catheter was then moved to this area (B), and ablation terminated the tachycardia within few seconds (C).

Left Atrial Appendage Potential

□ AF – Fractionated Potential



□ AT – Split Double Potential



Conclusion

- ◆ LA Appendage is an important source of localized reentrant AT in PeAF at repeat ablation procedures.
- ◆ Ablation targeting the site with long fractionated or mid-diastolic LA Appendage electrogram is highly effective in elimination of the arrhythmia.
- ◆ LA Appendage isolation results in a better clinical outcome in patients with longstanding PeAF.
- ◆ But LA Appendage electrical isolation has important implications for LA transport function, contractility disorders and the potential for thromboembolic complications despite maintenance of sinus rhythm





Korea University Arrhythmia Center



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