How to Do Durable PV Isolation

The Catholic University of Korea
Seoul St. Mary’s Hospital, Cardiology
Kim Sung-Hwan
How to Achieve Complete and Permanent Pulmonary Vein Isolation without Complications

Seongwook Han, MD\textsuperscript{1,2} and Chun Hwang, MD\textsuperscript{1}

\textsuperscript{1}Central Utah Clinic-Cardiology, Utah Valley Regional Medical Center, Provo, UT, USA
\textsuperscript{2}Department of Cardiology, Dongsan Medical Center, Keimyung University, Daegu, Korea

The efficacy and safety of catheter ablation for the management of atrial fibrillation (AF) has been improved in recent years. Radiofrequency (RF) catheter ablation for maintaining sinus rhythm is superior to the current antiarrhythmic drug therapy in selected patients. Pulmonary vein isolation (PVI) is the cornerstone of various catheter ablation strategies. It is well recognized that pulmonary vein (PV) antrum contributes to the AF initiation and/or perpetuation. Since PV stenosis is a complication of ablation within a PV, the ablation site for PVI has shifted to the junction between the left atrium and the PV rather than the ostium of the PV. However, PV reconnection after ablation is the major cause of recurrence of AF. The recovery of PV conduction could be caused by anatomical variations such as the failure to produce complete transmural lesion or gaps at the ablation line due to the transient electrophysiologic effects from the RF ablation. In this review, we discussed several factors to be considered for the achievement of the best PVI, including clinical aspects and technical aspects. (Korean Circ J 2014;44(5):291–300)
Why to Do Durable PV Isolation

1) Main mechanism of AF recurrence

2) High PV reconnection rate

3) STAR AF II
Why to Do Durable PV Isolation

1) Main mechanism of AF recurrence

2) High PV reconnection rate

3) STAR AF II
How many PV is reconnected?

- N=40, PAF, contact force-guided PVI.
- Two months later, all patients underwent EP study.
- PV reconnection was identified in......?

Das et al. Europace 2017
How many PV is reconnected?

- N=40, PAF, contact force-guided PVI.
- Two months later, all patients underwent EP study.

- PV reconnection was identified in 25 (62%) patients!

Das et al. *Europace* 2017
Why to Do Durable PV Isolation

1) Main mechanism of AF recurrence

2) High PV reconnection rate

3) STAR AF II
Even for persistent AF, PVI is enough?

P=0.15 for the overall comparison, by the log-rank test.

Freedom from Atrial Fibrillation (%) vs. Months since First Ablation

Pulmonary-vein isolation
Isolation plus electrograms
Isolation plus lines

STAR AF II, *NEJM* 2015
How to Do Durable PV Isolation with catheter ablation
To be expert...

if you are not expert,
Considerations

• Frequent reconnection site
  – RF energy, ablation time, waiting time

• Dormant conduction

• Bidirectional block
  – exit as well as entrance

• Ablation order

• New technologies
  – Contact force, ICE, Cryoablation…
Potential site

• Sequence change/isolation site
• Acute reconnection site
• PV to LA conduction site (exit conduction)
• Dormant conduction site (by adenosine)
APPLE study

Consecutive patients who underwent catheter ablation of AF from June 2012 to April 2015 (n = 394)

Overall patients (n = 378)
- De novo (n = 318)
- Redo (n = 60)

Exclusion:
- No PVI (n = 16)

PVI

Confirm of entrance block

Block (-)

Booster ablation

Block (+)

Confirm of exit block/
Adenosine 20mg

Dormant conduction (+)

Adenosine 12mg

Dormant conduction (+)

Adenosine 6mg

Dormant conduction (-)

Booster ablation

Exit block(-)

Confirm of PVI

3) potential change/isolation sites
4) dormant conduction sites
5) acute reconnection sites
6) PV to LA conduction

JY Kim, Oh YS et al. JICE 2016
Dormant conduction and Exit conduction

Patients with pulmonary vein isolation (n=378)

- Dormant (+): 74
- Exit conduction (+): 18
- 24.3% of 270 patients

- Adenosine 6mg, 12/92 (13%)
- Adenosine 12mg, 86/92 (93%)
- Adenosine 20mg, 92/92

JY Kim, Oh YS et al. JICE 2016
Lt. > Rt, carina, ridge and inferior segments

dormant conduction site  ≡ exit conduction site

dormant conduction site  ≡ exit conduction site

= reconnection site at redo

JY Kim, Oh YS et al. *JICE 2016*
Message from APPLE study

• High dormant conduction rate (24.3%)
  – intra LA, 20mg, regardless of AV block

• Additional benefit of exit conduction test
  – Dormant (-) & Exit (+): 4%

• Potential sites: left > right, ridge, inferior and carina

JY Kim, Oh YS et al. JICE 2016
Effectiveness of adenosine test: Pro

• n=401, PAF, Additional RF or Not for dormant

ADVICE trial. Lancet 2015
Effectiveness of adenosine test: Cons

- n=2113, PAF 67%, Adenosine vs Not

UNDER-ATP trial. *EHJ 2015*
Messages from these two trials

• Class 2B (2017 HRS Expert consensus)

• Adenosine test would be helpful
  – higher expected dormant rate (by junior, short waiting time…)
  – Paroxysmal
Considerations

• Frequent reconnection site
  – RF energy, ablation time, waiting time

• Dormant conduction

• Bidirectional block
  – exit as well as entrance

• Ablation order

• New technologies
  – Contact force, ICE, Cryoablation…
Expected reconnection site is first! (left, ridge)
Ablation order (2)

If transmural lesion, carina line is not needed for PV isolation.

Try to achieve PV isolation without carina line.
Summary

• If you are not expert, try adenosine and exit test. especially in case of paroxysmal.
  – intra LA, 20mg, regardless of AV block
• Wait 60 minutes ?
• Consider ablation order
  – Left, ridge
  – Try to achieve PVI without carina. Then add carina.