Dear Dr. Hwang,

It is a great pleasure to have priceless advice from you and to discuss important issues in the field of AF ablation. Whether roof line and area near LSPV is free from esophageal damage is uncertain. Although esophagus can have some distance from the catheter tip, temperature can rise since the esophagus is somewhere between catheter tip and ground patch as you mentioned. Another cause might be anatomical variation. I experienced severe esophageal injury in a patient with compressed esophagus between LSPV and aorta shown in following image with esophagus marked with white arrows. I assumed LSPV area is a relatively safe place and did not fully appreciate MRI image before the procedure which resulted in a kissing ulceration. Some patient has right-sided esophagus making RIPV a vulnerable spot for esophageal injury. Since barium-esophagography is routinely performed in our lab, I sometimes observe roof area (especially when roof line is tilted toward posterior direction) is very close to the esophagus. Antenna effect might happen with non-insulated esophageal temperature probes and result in esophageal overheating as demonstrated in a prior report (Heart Rhythm 2015;12:1464–1469). I heard that recent probes are usually insulated. However, if not insulated, it can be a cause of unanticipated temperature rise during ablation of posterior side of roof or LSPV.

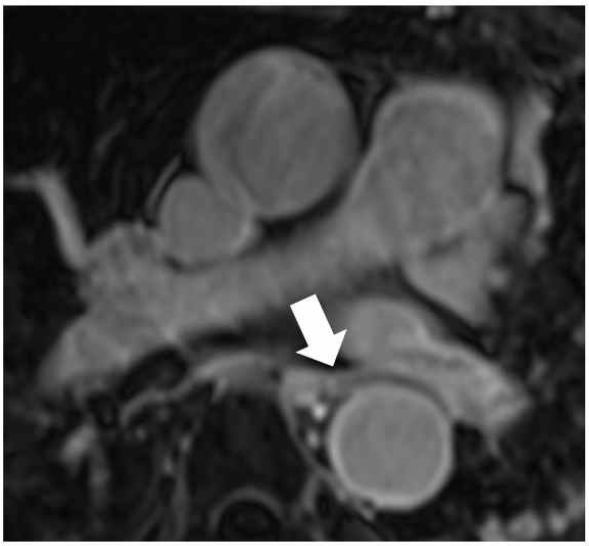
I fully agree with your advice on EGM-guided point-by-point ablation strategy in anywhere that can be close to the esophagus. I remember your comment posterior wall that is in direct contact with the esophagus is generally not thick and might not require high burden of energy delivery. In our prior report of AE fistula cases, all were associated with continuous non-interrupted ablation of posterior aspect of LIPV stressing the importance of preventing

temperature stacking (J Cardiovasc Electrophysiol. 2018;29:1343–1351). My personal practice to prevent esophageal injury is (i) thorough review of individual variation of esophageal anatomy; (ii) limitation of RF energy delivery close to esophagus including giving a break time; (iii) careful observation for esophageal pain and avoid general anesthesia (actually, general anesthesia is not possible in our lab and I think patient can feel esophageal pain with propofol sedation but may not with general anesthesia).

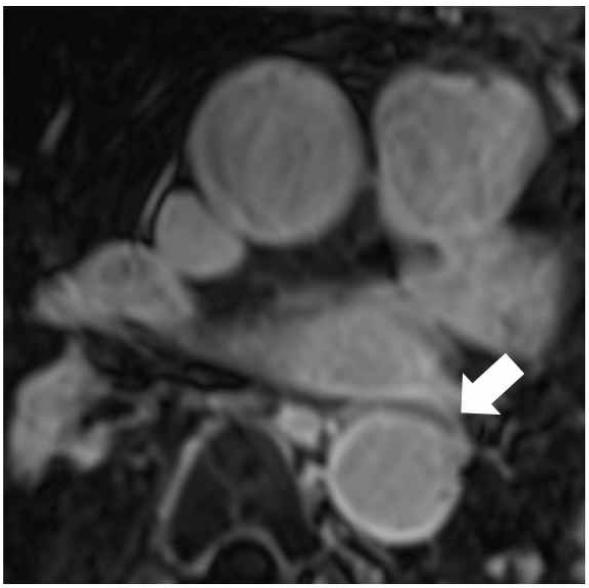
I and many EP juniors are truly gaining substantial benefit and inspiration by having these discussions with you and we are deeply grateful. I hope we can have much more lessons from you.

Sincerely,

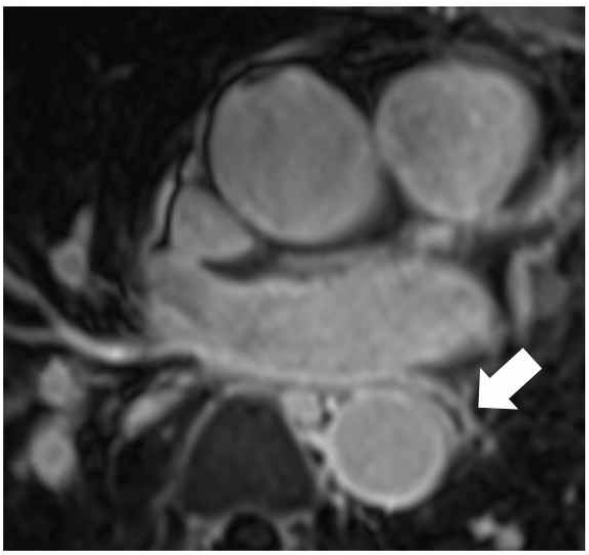
Yun Gi Kim.



Above LSPV level



Near LSPV level



Below LSPV level