

Dear Professor Kim

First of all, Thank you for your presentation during recent KHRS meeting. I enjoyed very much your presentation about high density mapping in left atrial complex arrhythmia.

I just want to explore further your question about the esophageal temperature rising during roof line. My impression from your question was that the esophageal temp should not be rising since there are no direct anatomical contact or proximity between the LA roof and anterior wall of esophagus. As moderator, I should ask you what was the reason that your asking question to explore further this issue.

Next time when you ask question, you should also ask why, what is the pathophysiological mechanism or process responsible? I am certain that these types of healthy discussion will benefit all participants. We may not have right or complete answer for the question but discussion can open the opportunity to bring new ideas or research ideas.

I thought about your question and these my personal view and comments why roof line or other ablation site can rise temperature in esophagus without being in direct contact.

Most frequently was perform endocardial unipolar RF ablation between the distal tip of ablation catheter to the ground patch located skin. This ablation technique can rise temp in all tissues between the catheter tip and ground patch. The hottest temp will be in cardiac tissue contact with catheter tip due to the highest energy concentration with high current density and then dissipate exponentially further way from the catheter tip toward the ground patch. The dissipation rate can be slowed when longer power and higher RF energy delivered. For example: if you perform high energy RF ablation duration longer (5 to 10 minutes using high power 35 watts), you can even observe ground patch burns (due to the energy build up at the patch and patch will be hot if you touch with your hand). There are cases reported in literature pt suffered 3rd degree skin burns. We experience of such case that required skin graft. Since then we have been using two ground patches to dissipate energy quicker by lowering impedance that avoided skin burns.

In cardiac level, if we ablate roof line, the location of linear lesion sets can differ operator to operator and there is no good defined guide line to tell us where the linear lesion set should be placed. Therefore, the roof line location may be the cause esophageal temp rises. For example, if roof line is placed more posterior aspect of LA roof in pts with Flat Back syndrome (severe lordosis) will result closer contact with the esophagus.

Other possible explanation is if you observe anatomy of pericardial sac. There is area in LA high posterior region that is not covered by the visceral and parietal pericardium (between the posterior and transverse sinus pericardial fold). The posterior pericardial fold area can vary widely pt to pt. The extreme case is the congenital absence of pericardium. If you ablated through the pericardial tissues (visceral and parietal) your impedance will be higher therefore less energy will reach esophagus and minimal temp changes but if deliver same energy through the roof region closer to the area with the absence of pericardial fold which has lower impedance resulting more energy will reach the esophagus.

Finally, Thoracic esophagus arterial blood are supplied by the small branches that originated directly from aorta, bronchial arteries, and right intercostal arteries. These arteries provide single terminal arteriolar vessels from external to mid muscular layer than minimal irrigation to endo-mucosa layer of esophagus. The small arteries courses along the external (adventitial) surface before penetrate into the muscular layer of esophagus. Therefore, there is no other arterial collaterals that can overlap for arterial supply.

If RF ablation lesion injures these small arteries or arteriolar vessels will result in rising esophageal temp. We all have experienced during ablation if you observe esophageal temp rise we stop the energy delivery but temp continues to rise for a while if your temp probe is placed properly. This fact is potentially explained by the fact that esophagus limited terminal blood flow anatomy. There is no set safe guideline for temp limit to prevent esophagus injury since many variables interplay in esophagus temp rising during RF ablation. There have been proposed several techniques reported in the literature. One of the such technique is high power and short duration that was presented during this meeting by Professor Choi.

I think key is that regardless which technique one use to ablated is good practice to use EGM guided point by point burn with titration energy and if temp rising is observed stop energy application until the temp recover to baseline and then use longer pauses between the RF ablation lesion to avoid accumulation of resist energy build-up.

Above factors are not the only ones that can rise esophageal temp. If you have other possible explanation, I would be very much hear from you. I hope these comments are useful to your practice

Best wishes and keep it up with good work