5 Expert Comments

Innapropiate Sinus Tachycardia: Current Challenges and Future Directions

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EXCERPT:

Various energy sources are available for ablation of cardiac tissue, including RF, Cryo, Microwave and Laser.

In RF ablation, alternating current is directly applied to the myocardium, which causes heating at the electrode-tissue interface. This results in energy being directly delivered to the first millimeter or so of the cardiac tissue at the electrode-tissue interface, beyond which successful ablation requires longer application times or increased energy levels to ensure the conduction of thermal energy deeper into the myocardium to the targeted site. The farther the ablation target is from the electrode, the more compoicated and unprecictable thermodynamics become, as energy dissipation occurs radially.

However, endocardial RF ablation often requires the creation of transmural lesions which are limited by uncertainty regarding the depth of the lesion and increased temperatures at the electrode-tissue interface. The additional limitations of RF energy for sinus node modification include a risk of permanent sinus node damage, necessitating pacemaker implantation; SVC stenosis; phrenic nerve injury; recurrence of symptoms of innapropriate sinus tachycardia; and sinus tachycardia.

Cryoablation, which uses cooling to create irreversible tissue damage, has the advantage over RF ablation in that it forms a more discrete lesion less prone to cause collateral damages to surrounding structures. As the periphery of cryolesions is not cooled in the same extend as the catheter-tissue contact point, creating deep lesions via cryoablation is still limited. Clinical experience with cryoablation for sinus node modification is very limited. There is a published case report in existence that employed cryoablation for sinus node modification that resulted in phrenic nerve injury.

Electromagnetic energy theoretically allows for creation of controlled, deep lesions in the myocardium. Microwave energy propagation can more easily penetrate into deeper tissues. However, the design of microwave antennae is technically challanging, and there are no clinically available endovascular microwave catheters in existence at present.

Laser uses photons at specific wavelengths within the infrared , visible, or ultraviolet ranges of the electromagnetic spectrum, resulting in the heating of cardiac tissue by absoption of photons and the photothermal effects. Laser has shown promise in development of transmyocardial lesions, the depth of which were related to the duration of the photon energy application.

This publication by Weber et al. is an excellent example of translating basic science research into direct patient care. A patient with innapropriate sinus tachycardia was treated with laser ablation. The procedure was successful in identifying a targeted site for SA node ablation and laser energy was successfully delivered without complication. However, unlike the animal studies, the local atrial potentials were not abolished, though they did decrease.

Summary:

This study demonstrated the successful identification of a target site for ablation in humans and the successful application of laser energy without complications.