Imaging Is the Key to Ablation Improvement

BY ROBERT FINN
San Francisco Bureau

SAN FRANCISCO — "The future of ablation has very little to do with ablation," Dr. Jaime Landman said at the annual meeting of the Society of Laparoendoscopic Surgeons. "Ablation is about targeting, and targeting is clearly about imaging."

Dr. Landman, of Columbia University, New York, described a number of technical developments that may improve the utility of ablation technology in surgery.

Although cryoablation, radiofrequency ablation, and brachytherapy have been the most frequently used modalities, there's a new kid on the block, he said. High-intensity focused ultrasound (HIFU) involves ultrasonic radiation focused by a lens, a curved array, or a phased array to target extremely small areas of tissue—on the order of a few millimeters—for heating and destruction.

This very precision, however, is both HIFU's beauty and its Achilles' heel, Dr. Landman said. The small focal zone makes it difficult to target a large area such as a tumor or a benign growth.

"I still think [HIFU] has a long way to go," Dr. Landman said. "This is a beautiful technology. It is less invasive. It's not percutaneous; it's transcutaneous. And theoretically it can become a wonderful ablative modality."

HIFU may prove especially useful when coupled with robotic targeting. An early example of this kind of robotic technology, called PAKY (Percutaneous Access of the KidneY), was designed for fluoroscopic-guided percutaneous needle insertion into the renal collecting system. Several groups are working on computer technologies that will combine stored CT images with real-time ultrasound images to target robotic probes to precise locations for biopsy or ablation.

Even more exciting is the "stealth robot," so-called because it is compatible with real-time MRI imaging, he said. Propelled with a pneumatic motor and constructed exclusively of materials such as plastics, ceramics, crystals, and rubber, stealth robots are also electricity free, using light signals internally. All electrical components can be located outside the imaging room (Minim. Invasive Ther. Allied Technol. 2007;16:241-8). The stealth robot could potentially allow the surgeon to target a precise location for ablation while the patient is inside the MRI tube being actively scanned.

On the subject of ultrasound, a technology in frequent use today, Dr. Landman said, "Ultrasound is incredibly useful. … We all use it, it's commonly available, and it's relatively inexpensive. But it's been hampered in ablation in that we need to know what's viable. This is the most important part of ablation—making tissue that we don't want viable dead. Unfortunately we have not been able to do that in ultrasound because of the lack of contrast material."

Enter contrast-enhanced ultrasound. The contrast agent contains large numbers of gas-filled microbubbles. Injected into the circulatory system, these microbubbles have a high degree of echogenicity and can be used to image blood perfusion.

Dr. Landman himself has been working on computer-assisted ultrasound targeting. It consists of a familiar ultrasound probe with a slight modification—the addition of a needle guide that's connected by computer to a targeting mechanism. In in vitro demonstrations, the operator can easily hit a 1-mm target with the needle.

"Now this doesn't look particularly remarkable until I tell you that the person who did this is a first-year medical student who never touched an ultrasound before in his life," Dr. Landman said. "And he was able to go 10 cm deep and hit 1-mm targets. This means to me than in the very near future I'm going to be able to take this device and take a kidney tumor and treat it in my office with cryoablation."

Dr. Landman urged the surgeons in the audience to become proficient in ablative technologies including associated imaging and targeting modalities, implying that if surgeons don't enter this arena, others will fill the void. "Our training as surgeons has been very limited regarding imaging," he said. "And it's very clear that imaging specialists, interventional radiologists, have been very aggressive and very pleased to proceed with ablative procedures."

Dr. Landman disclosed receiving grant support from and serving as a consultant to a number of companies involved in imaging and ablative technology. ■