Revolutionizing Mammography

Digital mammograms are an improvement over standard film mammograms.

Women in the United States have a one-in-eight chance of developing breast cancer at some point in their lives, making the accuracy of diagnostic tools critical. With this in mind, Lahey Clinic has begun a multitiered initiative to explore the most advanced technologies available to aid in breast cancer diagnosis.

The Clinic will be purchasing four digital mammography machines as part of a joint research initiative with the American College of Radiology Imaging Network. With images digitalized, it will be possible to use computers to aid in diagnosis.

Anna K. Chacko, MD, chair, Diagnostic Radiology, and Rashmikant Shah, MD, Diagnostic Radiology, were among the first in the world to develop and use digital mammography when they served at the Brooke Army Medical Center in Texas. Approved by the FDA in January 2000, digital mammograms are an improvement over standard film mammograms in that the amount of time to acquire a mammogram is reduced and fewer repeat mammograms are needed.

Vice Admiral Susan Blumenthal, MD, pioneered the concepts of computer-aided diagnosis and digital mammography. She recommended employing mathematical algorithms—similar to those used by satellites in locating camouflaged objects—to find lumps hidden in the breast.

Lahey's long-term plans include combining mammograms with ultrasound or MRI. "Women who are young have dense breast tissue, so you can't see lesions very well. We're looking at whether it is more effective to use mammography along with ultrasound," says Chacko.

The Clinic may also begin using "fusion" technology. "You morph the images so that you can detect lesions and their geographic location in the breast better," says Chacko.

MRI mammography is unique in that it delivers no harmful radiation, is highly accurate, and has soft-tissue properties that allow it to detect cancer that is not calcified. Chacko says this type of mammography may prove beneficial to young women who are at risk of breast cancer and begin mammograms earlier in life than most.

"I think a young person should have the liberty of relief from worry. I predict that in five or six years, MRI will become the main screening procedure for breast lesions," says Chacko.

The Science of Nerve Regeneration

Researchers at Lahey Clinic continue to push the boundaries of the field of tissue engineering, most recently developing methods to optimize regeneration in traumatized nerves.

David J. Bryan, MD, and his colleagues were among the first to grow human Schwann cells in culture and demonstrate their function in nerve regeneration. Now, Bryan is working to identify specific molecules that could be used to enhance nerve growth.

"The emphasis of this research is to try to understand the basic science of how nerves communicate with one another and with other cells in their environment, and how the nervous system tries to repair itself," says Bryan. "We have to look at how nerves grow in the embryo in order to identify what combination of cells, growth factors, and particularly genetics, results in optimal nerve regeneration."

In order to mend a gap in a severed nerve, physicians must transplant a nerve graft via microsurgery—requiring sacrifice of a donor nerve from another site on the patient's body. If the gap is small enough, physicians can avoid grafting by implanting a bioreabsorbable nerve guide that Schwann cells—cylindrical cells that guide regenerating nerves—can migrate across.

What Bryan's laboratory found is that if nerve guides are first incubated in muscle so they fill with cellular components, Schwann cells migrate across them quicker, leading to more efficient nerve regeneration. His research is now geared toward identifying which individual components of muscle tissue cause enhanced nerve growth.

While the aim is to better understand the basic biology of nerve regeneration, Bryan hopes that in the process, researchers may potentially develop a method to mimic the cellular environment of a growing embryo. The stem cells that facilitate embryonic nerve growth, he says, might some day be used in the clinical arena for treating neurodegenerative diseases and other disorders of the central or peripheral nervous systems.

"In the embryo, the nerve system has to develop from scratch, requiring very sophisticated communications, and all of this presumably is controlled by the up and down regulation of gene sequences," says Bryan. The ultimate goal would be to deliver embryonic stem cells into the environment of the injured adult nerve, where they could possibly serve to promote and regulate nerve regeneration.

"Tissue engineering is very powerful, not only in understanding an exceedingly complex system, but also in exploiting this system to end up with a functional recovery that is superior to what we can currently give to patients," says Bryan.