Bringing Prostate Cancer into the Light

The time has come, say medical experts from around the country, to advance medical care of prostate cancer—with molecular imaging leading the way.

"We have a prostate cancer crisis," says Faina Shtern, M.D., president and CEO of the AdMeTech Foundation. "There is an opportunity for imaging to transform patient care and end this crisis."

The Problem: A Hidden Cancer

Prostate cancer strikes one in six men. Like other cancers, it is most curable when it is diagnosed at the earliest stage. Yet the primary tool used to diagnose prostate cancer—the PSA test—is inadequate. Although the test has saved lives since it was introduced, it also produces a high rate of false negative and false positive results (indicating cancer is present when it isn't and vice versa).

What's more, in two-thirds of all needle biopsies performed, no cancer is found. When cancerous tissue is identified, physicians have no way to differentiate biologically aggressive tumors from slow-growing disease. The result is often overtreatment, which costs an estimated annual $3 billion year in the United States and takes a significant toll on men who experience treatment side effects including incontinence, rectal injury and loss of sexual function.

"A major issue today is a lot of prostate cancer is overtreated," says Martin G. Pomper, M.D., Ph.D. professor of radiology and radiological science at Johns Hopkins Medical School in Baltimore. "Men have their prostate removed for cancers that aren't life-threatening."

Adds Dr. Shtern, "The lack of accurate imaging leads to of a staggering number of unnecessary biopsies and treatments."

The Solution: Molecular Imaging

Definitions

PSA Test: a blood test that measures the amount of prostate-specific antigen (PSA) produced by the prostate gland

Needle biopsy: A hollow needle extracts 12-18 cores of tissue to be examined in a laboratory

Biomarker: an indicator of biological and pathological processes occurring in the body, such as cancer

Active surveillance: Safely monitoring low-grade prostate cancer

Focal therapy: treating diseased tissue while sparing healthy tissue

PET Imaging: an imaging study that uses a radiotracer to visualize 'hot spots' of chemical activity within the body.

Researchers across the country are hopeful about the many studies underway to determine how molecular imaging can improve the diagnosis, staging and treatment of prostate cancer.

Molecular imaging is ideal for assessing the prostate gland, which as the body ages undergoes benign processes such as inflammation and infection that can mimic cancer. Where other diagnostic imaging procedures visualize the structure of organs, molecular imaging allows physicians to detect cellular changes that occur early in the course of disease.

"Anatomical imaging of the prostate gland just doesn't provide enough information," says Dr. John Kurhanewicz, Ph.D., professor of radiology and biomedical imaging at the University of California, San Francisco (UCSF). "We need imaging that provides us with functional information about the prostate."

Using various molecular imaging technologies, Dr. Kurhanewicz and other scientists are looking for biological changes that occur as a result of cancer and in response to treatment. These indicators, called biomarkers, could provide an early warning sign for cancer or measure the body's response to drug therapy. And by studying both prostate cancer patients and men with a family history of the disease, researchers hope to identify biomarkers that can predict the progression of disease or a patient's response to treatment.

How Does Molecular Imaging Work?

Molecular imaging involves an imaging agent or probe that hones in on a specific target or cellular activity in the body and can be detected by an imaging device (similar to a camera) that takes pictures of and measures that activity. In PET and SPECT scans, the imaging agent is a radiotracer, a compound that includes a small amount of radioactive material.

PET scans and other molecular imaging studies such as the PSMA study and bone scan play an important role in staging prostate cancer by helping doctors determine the aggressiveness of the disease and whether it has spread elsewhere in the body. To better image the many different forms of prostate cancer, Steven M. Larson, M.D. and other scientists are testing a variety of new radiotracers.

Image-Guided Biopsy

Imaging is increasingly being used in prostate biopsies to improve the accuracy of the procedure.

"Needle biopsies only sample a small portion of the gland, which leaves most of the prostate unsurveyed," explains Dr. Kurhanewicz.

In a MR US-guided procedure, magnetic resonance images that map the exact location of suspicious lesions are fused together with real-time ultrasound imaging to help guide the physician in placing the biopsy needle.

"Prostate biopsy with MR is able detect up to 60 percent more lesions than blind biopsy," says Dr. Shtern.

Researchers are also experimenting with a contrast agent for ultrasound—tiny hollow spheres called 'microbubbles' programmed to hone in on new blood vessels around a tumor. Using real-time ultrasound, the microbubbles point the way for a biopsy needle or laser to kill cancer cells.

"There's a recognition that molecular imaging is increasingly important to prostate cancer and people are excited about its prospects," says Dr. Larson, chief of nuclear medicine at Memorial Sloan-Kettering Cancer Center in New York.

Researchers are also exploring applications for optical imaging, in which a light-producing protein literally illuminates the dark interiors of the body. At Johns Hopkins, Dr. Pomper is studying a new optical probe to help surgeons achieve clearer margins when removing a tumor. Cancer experts are especially enthusiastic about hybrid imaging, in which images produced by multiple technologies are fused together to provide a more comprehensive view of the body.

"The impact of MR/PET machines could be enormous," says Dr. Kurhanewicz.

New Treatment Options

The information provided by molecular is imaging also offering the possibility of new treatment options for prostate cancer.

By better characterizing the extent and aggressiveness of a patient's cancer, molecular imaging may allow for a more targeted, or focal treatment of the prostate, offering an alternative to surgical removal and radiation therapy that treats the whole gland.

"A few years ago, no one considered focal therapy for prostate cancer," Dr. Kurhanewicz. "Now it's being thought of as a viable approach."

Similar to a lumpectomy of the breast in which a tumor is removed but the rest of the breast is left intact, focal therapy of the prostate is directed only at the diseased portion of the gland while sparing its healthy tissue.

Another treatment option made possible by advanced MR imaging is active surveillance, in which slow-growing disease is safely monitored.

"More patients are embracing active surveillance, especially younger men who have a problem with the potential side effects of treatment," says Dr. Kurhanewicz. Each year at UCSF, he performs MR studies on hundreds of patients undergoing active surveillance to ensure biopsy procedures haven't missed any hidden cancer.

Overtreating Less, Curing More

To reach the goal of overtreating less and curing more prostate cancer, experts say more funding is needed to fuel molecular imaging research.

"Molecular imaging offers us three potential advantages," says Dr. Shtern. "The ability to detect prostate cancer early, characterize its aggressiveness and to determine its stage"

But in addition to scientific progress, she says we also need a public conversation about this long-hidden disease.

"In order to change the practice of medicine, we must increase public awareness of prostate cancer as a major public health issue and make research funding that advances molecular imaging a national priority," she says.

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