Innovations in Radiology

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Cancer of the colon and rectum, often called colorectal cancer, is the second most common cancer diagnosis in the United States. When the disease is diagnosed and treated early, before it has spread to other organs, it is highly curable. Unfortunately, only 37% of colorectal cancers currently are found at this early stage.

Why? Colonoscopy is one of the most important screening tools available to detect colorectal cancers in the early, more treatable stages. However, it is often avoided by patients due to fear that they will experience discomfort or embarrassment during the procedure. Of the 12 million Americans needing annual colorectal cancer screening, fewer than two million actually undergo traditional colonoscopies each year.

Patients' unwillingness to undergo routine colonoscopy led Dr. David Vining's team at Wake Forest University School of Medicine (WFUSM), Winston-Salem, North Carolina, US, to pioneer *virtual colonoscopy* (VC) technology. This new screening test for colorectal cancer can improve early detection rates by making screenings easier and more comfortable for patients. It is available at only a few locations throughout the United States, and has not yet penetrated international markets significantly.

WFUSM has created a Virtual Endoscopy Center to address patient demand for the procedure, and currently processes approximately 25 cases per week (with one radiologist dedicated to managing the VC cases). Dr. Vining's clinical reputation, in conjunction with substantial national media coverage about the procedure, has helped to establish WFUSM as one of the premier U.S. sites for VC.

Marion Douglas, a patient who recently underwent a VC procedure, is a strong proponent of the new technology. With a family history of colon cancer, she takes her good health

very seriously. She has an extensive physical every year and has undergone two traditional colonoscopies.

 "My father died of a very aggressive colon cancer when he was only 56, so I am diligent in having colonoscopies every five years," Douglas told me. When she was approached with the opportunity to participate in a study of virtual colonoscopy, she jumped at the chance. "This is an amazing technology," she added, "and I think it will prove to be an invaluable screening tool. It is quick and simple and really gives you peace of mind. I know how devastating cancer can be to a family, and I'm thankful that we have this exciting technology available here in Winston-Salem."

The Procedure

For a VC procedure, the patient is given a laxative and an oral contrast agent prior to computed tomography (CT) scanning. The colon is inflated with carbon dioxide gas to make it easier to view the inside of the colon. VC uses a multislice helical CT scanner to take hundreds of images of the colon. Specialized computer software converts this information into a three-dimensional rendering of the colon that a doctor can inspect for abnormalities. No sedation is necessary for the test – which takes less than 15 minutes to complete – so patients can return to work or resume their normal activities immediately afterwards.

With traditional colonoscopy, the bowel cleansing process is a major contributor to poor public perception about the procedure. New cleansing regimens developed at WFUSM are improving public acceptance of VC. In addition, we have found that a courteous, efficient staff is helpful in alleviating patient apprehension. Our patients appreciate having friendly technologists capable of demonstrating empathy for their fear and discomfort, and who can provide clear instructions that patients can understand. Simple directions improve patient compliance for bowel preparation and breath holding during CT scanning. We have also found that a sense of humor can often diffuse uncomfortable situations.

VC is best conducted in streamlined outpatient centers using multislice helical CT scanners (these machines can image the colon in 20 seconds or less).
To efficiently analyze the hundreds of images generated by a CT scan, it is essential that a robust and accurate image analysis tool be employed. At our institution, the PointDx REX™ reporting software (see below) is utilized to generate VC reports within ten minutes of analysis. The REX™ system permits the physician to process as many as four or five VC cases per hour.

Following the generation of a report, it is imperative that any positive results be communicated to referring physicians and patients quickly. In addition to those findings identified in the colon, significant incidental findings (for example, abnormalities in the kidneys) are found in 20% of patients. This is one of the greatest advantages of VC – the ability to detect unsuspected disease in other abdominal and pelvic organs.

The Business

To succeed, VC must be made available and convenient to the population over 50 years of age who are most susceptible to colon cancer. WFUSM's Virtual Endoscopy Center

permits patients to undergo a VC procedure for a nominal fee ($750 US). As this technology becomes more widely available, it is estimated that eight to 12 million VCs will be performed every year in the US.

Other Applications Resulting From VC Research

The virtual endoscopy research conducted at WFUSM has led to the formation of a medical software company. *PointDx, Inc*., has created an innovative image analysis and structured reporting software package designed to improve the efficiency, speed and accuracy of radiology reporting, and ultimately revolutionize the practice of medicine.

In the mid-1990s, as Dr. Vining's team worked to create an image analysis and reporting platform capable of supporting the vast data generated by VC studies, it became clear that they were developing a product with broader applications than just VC. The software they created could be used to change how radiology reports are created for all modalities – improving radiology's quality of service and patients' quality of care.

According to Dr. Vining, "The light bulb went off about two years ago. Like so many discoveries, it's not so much finding the answer, but finding the right question. Out of virtual colonoscopy grew a new reporting engine. What we had was a problem, and we used technology to solve the problem."


The universal problem associated with radiology reporting is the time it takes for a radiologist to analyze and dictate a report, for someone to transcribe those results, for the radiologist to review and approve the transcription, then for the approved report to reach the patient's medical record. That process averages 27.7 hours in "premier" hospitals and 38.3 hours in university hospitals, according to a 1995 benchmarking study by the Washington, DC, Medical Leadership Council.

The REX™ reporting system reduces the time- and resource-consuming process of traditional radiology reporting to a single step. The report is created as the radiologist analyzes the image, distributing it simultaneously via the Internet following the physician's approval of the findings.

The system delivers a web-based multi-media report to a referring physician, and sends the appropriate information to the hospital or practice billing system.

The REX™ system supports a number of advanced features, as well, including:

- foreign language translation
- disease tracking
- integration of three-dimensional analysis tools
- datamining of health statistics
- access to healthcare information portals
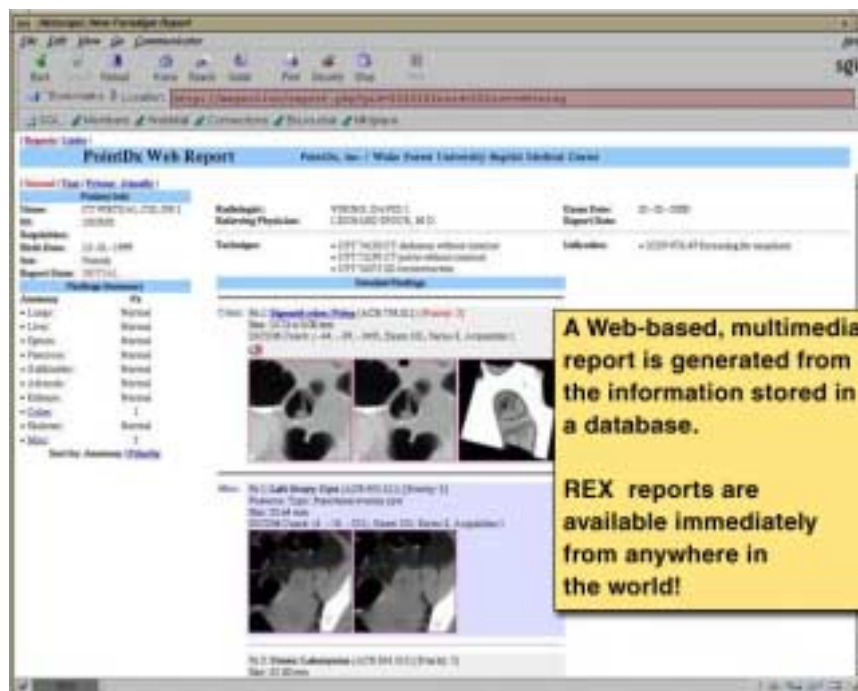
PointDx is in the process of transitioning its SGI-based REX™ research prototype to a PC platform, and plans to announce a commercial product at the November 2001 meeting of the Radiological Society of North America (RSNA) in Chicago, IL, USA. The open architecture of REX™ enables the licensing of components that can be easily integrated with any information technology (IT) systems currently on the market. REX™ is the perfect complement to the product offering of any Picture Archiving Communications System (PACS), Radiology Information System (RIS), Hospital Information System (HIS) or practice management system vendor. PointDx is presently in strategic partnership discussions with a number of international IT system manufacturers.

The corporate structure of PointDx consists of three divisions. *Clinical Solutions* is tasked with creating innovative software applications and is responsible for integrating the REX™ product with existing hospital IT systems. The *Medical Informatics* division of the company maintains and distributes up-to-date diagnostic code sets and medical information portals that are integral to the REX™ reporting process. *Data Mining* offers

outcomes analyses to government agencies and insurers using the company's comprehensive database of report information.

PointDx is poised for tremendous growth in the coming years, as strategic alliances are formed, and REX™ is expected to proliferate the marketplace. More information about REX™ can be found at the company web site, *www.pointdx.com*, or by contacting PointDx at 336.723.1450.