New Methods for Medical Imaging to Lower the Dose of Radiation

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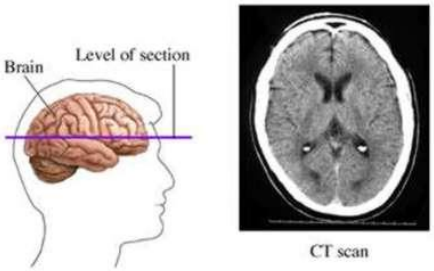
The term CT scan is short for computed tomography and this is also known computed axial tomography. This is an x-ray procedure used every day in the



medical world. The procedure takes multiple x-ray images in slices. The slices are then put back together to create a 3 dimensional image of the components inside a human body. These images can range from images of the brain to images inside a person's body cavity.

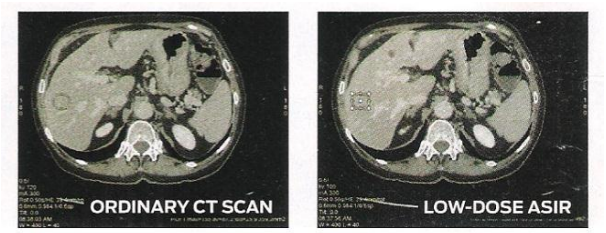
The first CT scan was developed in 1970 and was developed mainly for head imaging. These systems took hours to collect enough slices for an image. Though primitive, this system lead to one of the world most frequently used medical procedures. In order to use CT scans contrast agents are needed to highlight the objects being scanned in the human body

The number of people employing the use of CT scans increases every day. In 1980 the number of scans being used was approximately 3 million. By 2007 the number of scans increased to 70 million scans. This is an 86% increase per year over 27 years.

CT scans are useful but few are aware that it can be hazardous technology. Amongst the 70 million having CT scans 29,000 will eventually get cancer and 14,500 will die from this cancer. As noted by Arthur T. Johnson in his article in the BMES bulletin, as simple head injury requires 21 scans all of which took place over a course of 4 days. Some argue that the use of 21 scans for one simple injury is excessive and unnecessary.

Now a major focus for BME is to find a substitute for CT scans. There are three major methods under development. The first is ASIR which stands for Adaptive Statistical Iterative Reconstruction created by GE. The second is Iterative Reconstruction in Image Space created by Siemens. The third is interior tomography being developed by Dr. Ge Wang at Virginia Tech.

Adaptive Statistical Iterative Reconstruction method uses less intense X-ray beams. This causes more noise however through voxel comparison which is volumetric pixel comparison the noise can be removed. When pixels are too different from adjacent pixels they are discarded as noise. The ASIR system uses 32-65% less radiation while retaining all pertinent data. For heart scans it has 90% radiation reduction.



CATCH FEWER RAYS: Tricks of image reconstruction spare the patient by making every X-ray photon count.
PHOTO: IAN HOOTEN/GETTY IMAGES; IMAGES: GE HEALTHCARE (2)

Iterative Reconstruction in Image Space system is similar to ARIS in the fact that it deconstructs and reconstructs images. IRIS will become available by the second half of 2010. IRIS was not possible sooner because it is very computationally intensive and the technology needed to decode the algorithms was not readily available.

Interior Tomography is a low dose scanning system being developed at Virginia tech. The main idea behind this method is to take scans of smaller areas. The image is only taken within the edges of the area of interest. For example to image the heart the entire chest cavity is not scanned instead only the area near the heart to and from the edge of the body are scanned. Here the edges are not defined by the cavities in the body however it is instead determined in reference to air pockets or regions of blood thereby requiring a smaller area to be scanned. By reducing the area that is scanned the dose can be reduced proportionally. The algorithm for this method relies on Hilbert transforms.

As CT scans continue to be used in the medical world it is important to continue work to reduce the risk of cancer that comes with employing this technology. These three methods or scanning are just a few amongst many alternative methods that are sure to become available in the future.

Works Cited

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