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EDITORIAL

REVOLUTION NEXT – THE MULTIDETECTOR CT

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The year 1995 was celebrated as the centenary year for the discovery of x-rays – a discovery that opened previously unimaginable vistas for visualizing the anatomy and pathology of the living. Skin was the limit. It was the same time when the question was being asked: is it possible to carry out isotropic imaging using thin section three-dimensional spiral CT?[1] A hundred years after the phenomenal discovery by Röentgen, another revolution was in the making. It was the multidetector CT (MDCT).

CT scanners have been all essential parts of the imaging armamentarium since their introduction in 1970's. In the last one and-a-half decade the sophistication in computer hardware technology and post processing of the data reached a point to allow the practices of volumetric imaging and MIP projection that let the CT scanners cover larger volumes of tissues in markedly smaller time with less radiation. This evolution began with the conventional single slice scanner through helical scanning to the multi-detector technology. In the latter, the detector array has multiple detector rows allowing multiples of thin visual slices to be acquired simultaneously through a larger volume of tissue in a short time. The current 64-slice CT scanner for instance, delivers 0.5 mm thick slice of tissue per rotation with superb temporal and spatial resolution in a single breath hold. It is upto 8 times as fast as the single slice helical CT, so motion artifacts induced by breathing, bowel movements and even heartbeat are minimized. As the CT scanner technology advanced, each successive system was built upon proven clinical usefulness with the 4-, 16-, 32-, 64- and 128- slice scanners providing better and better quality images.[2] It was not until the discovery of the 16- slice scanners that the angiography potential and versatility was appreciated by the clinical stake holders.[3]

But how do these different advanced CT scanners compare? Moving from the single slice to the 16-slice scanner exponentially improves the image quality. However, there is little discernible difference between the 16- to the 64- slices systems' speed, the thin-slice high-resolution image quality, and the workload capabilities for routine abdominal, pelvic, chest and brain procedures. The real difference is in the three phase liver and kidney imaging and computed tomographic angiography (CTA) where the 64- slice scanner produces faster and better images. The intermediate strategy i.e. the 32-slice scanner is usually employed for the relatively resource – constrained department determined for upgrading the CT equipment.

Presently, the main goal of installing a MDCT in an institute is to extend the cardiac imaging work. An intelligent utility for improving the feasibility and cost-effectiveness makes innovative uses mandatory, such as neuroperfusion studies, measuring vascular density and blood flow in tumours; and ultra-high resolution imaging of temporal bone and peripheral and axial skeleton at lower radiation doses. However, before installing a 64- slice MDCT, a robust PACS is needed with I.T. infrastructure backup to manage the over-whelming data flux and volume from such system.

The introduction of the MDCT has led to marked paradigm shifts in evaluation (and prevention in case of cardiac) diseases. For any given clinical situation – emergent or otherwise, the appropriate imaging study is the one that brings more benefits than risks to the patient care. CT has long been an opt choice for many such situations.

As alluded to earlier, the main such paradigm shift was that the 16- and 64- slice scanners brought radiology back in to the cardiology discipline allowing the cardiologists and the radiologists to work in unison and collaboration for interpreting the data. Cardiovascular imaging practice exploded to the extent of attracting popular media and, therefore, the common man's attention. It is virtually replacing the invasive angiography for diagnostic purpose. Pioneer radiologists on the scene, now use the term 'angiography' for CTA and 'luminography' for invasive catheter angiography. It assesses the coronary artery disease in and beyond the lumen; scores calcium content on coronaries, identifies the vulnerable plaque, visualizes complex anomalous origins of the coronaries; determines left ventricular volume and regional wall motion abnormalities, evaluates the endovascular stents; and renders visible the 4-D images of the cardiac valves, all by non-invasive means. This is certainly nothing less than exciting.

Equally exciting are the abdominal and skeletal applications. Volumetric imaging is now allowing accurate pre-operative delineation of the inter-relation of the relevant hepatobiliary, urinary tract and arterio-venous anatomy, which are critical for the prospective donor – transplant duo and for those undergoing palliative and curative resections. Aortic aneurysms, for another instance, can be evaluated pre-operatively to an extent to allow for selection of suitably sized and designed stents according to the anatomy of the neck of aneurysm, the extent and the state of the off shoots. Virtual colonoscopy is possible after failed fibreoptic colonoscopy. Multiplanar imaging of the small joints of foot and particularly the postoperative spine is another robust application arena.

The major strength of the MDCT is the high-negative predictive value for exclusion of disease. The radiation dose is not a major issue. It is said that absorbed dose can be upto 40% higher for a multislice helical CT than for an equivalent conventional CT.[4] It is inversely related to the efficiency of detection. Reconstruction methods and system design can reduce dose by allowing increase in pitch without increasing mAs. The cost may be higher initially but over a long run, the overall cost of health care with improved diagnosis on outpatient basis.

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The future of MDCT is envisioned with 256- and 521- slice scanners, which may cover the heart and lungs in a single heart beat, or study tumours in micro-environment or scan the whole organ perfusion in a single rotation or allow functional imaging.

Still, it is a technique in infancy with only the surface of the potential new applications being opened up and long-term results awaited. Indiscrete use for screening should be discouraged by properly focused medical decision - making and assessing patients on history, physical findings and risk evaluation.

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