AbstractID: 7068 Title: Advances in 3-D image acquisition

The last two decades have witnessed unprecedented developments of new imaging systems making use of 3-D visualization. These new technologies have revolutionized diagnostic radiology, as they provide the clinician with information about the interior of the human body never before available. These developments have clearly demonstrated that 2-D viewing of 3-D anatomy, using conventional techniques, limits our ability to quantify and visualize a number of diseases and is partly responsible for the reported variability in diagnosis. This occurs because: (i) conventional 2-D techniques require the diagnostician to integrate multiple images in their mind to develop a 3-D understanding of the pathology. This practice is inefficient, and may lead to variability and incorrect diagnoses; and (ii) a 2-D image represents a thin plane at some arbitrary angle in the body, making it difficult to localize the image plane, and reproduce it at a later time for follow-up studies.

Over the past 2 decades, a number of investigators have addressed these limitations by developing 3-D ultrasound; 3-D computed rotation angiography (CRA); and 3-D MRI imaging techniques. In this paper we describe these developments, such as 3-D B-mode, color Doppler and power Doppler ultrasound, neuroangiographic 3-D CRA and 3-D MRI/fMRI for imaging organs such as the brain, prostate, heart, breast, kidney and liver. Examples will be discussed in the use of these techniques for quantitative morphological and functional imaging as well as for image-guided surgery and therapy. Limitations of these techniques related to resolution, acquisition speed and artefacts will be described and new research directions will be discussed.