PRACTICAL CLINICAL EVERYDAY APPLICATIONS OF 3D IMAGING

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Introduction:
The past decade has witnessed a great expansion in the clinical application of 3D imaging whether it be with computed tomography (CT), magnetic resonance (MR) or ultrasound imaging.

The aim of this study is to present our experience of CT, MR and ultrasound 3D imaging. In particular, we emphasise those clinical everyday applications which we find most beneficial and those applications which are of limited practical benefit currently.

Methods:
Our radiology department is located within the Prince of Wales Hospital and affiliated to the Chinese University of Hong Kong. A spiral computed tomography (CT) scanner (General Electric, Hi-Speed Advantage) has been operational for over 5 years and 1.5 tesla magnetic resonance (MR) scanner (Philips, Gyroscan) for over 3 years. In addition, we have acquired a range of high performance ultrasound machines. At the moment, our access to 3D ultrasound is limited to colour Doppler 3D. Over 12,000 CT examinations, 4,500 MR examinations and 22,000 ultrasound examinations, are performed per annum. Based on our experience, those clinical applications of 3D imaging which we found most and least useful in everyday practice were noted.

Results:
CT was the most common modality used for 3D imaging. The main clinical applications were 3D of the musculoskeletal system and 3D cerebral angiography. In the musculoskeletal system, 3D images are particularly useful in assessing trauma of the large bones and joints (shoulder girdle, pelvic girdle, knees and ankles) as well as complex mid-face fractures.

It improved overall perception for both the reporting radiologist, the clinician and was a very helpful means of conveying the complexity of the injury to the patient and relatives. We also found it useful in assessing complex deformity or congenital abnormalities of the spine particularly at the cranio-vertebral junction. In general, the greater the degree of fracture displacement or deformity, the greater the benefit from 3D imaging. Other musculoskeletal applications were prior to pelvic to aid prosthetic replacement and prior to craniotomy for craniostenosis. 3D cerebral angiography has become routine practice in the detection of cerebral aneurysms of the Circle of Willis and its main branches. It is used on an almost daily basis in patients presenting with subarachnoid hemorrhage or specific neurological deficits.

Other common applications of 3D imaging are 3D reconstructions of the abdominal aorta and its major branches, 3D reconstruction of the airways, 3D volumetric lung imaging and 3D reconstruction of the oesophagus in patients with oesophageal tumours.

With respect to MR imaging, the most frequent and useful application of 3D imaging is in MR angiography and reconstruction of the main cerebral vessels, the aorta, the abdominal vasculature and the arteries of the upper and lower limbs. These applications are applied clinically on a regular basis.

With respect to US, colour 3D imaging is mainly used as an experimental tool in our department as its accuracy and reproducibility is not as yet acceptable as a standard diagnostic tool.

Conclusion:
3D imaging is playing an ever increasing and important role in modern diagnostic radiology departments. Those applications which have gained common acceptance are the musculoskeletal and cerebral angiographic applications of 3D CT imaging as well as the angiographic applications of MR imaging. 3D imaging with US has yet to gain common acceptance.