Three dimensional computed tomography

The first computed tomographic scans became available in 1972 following the Nobel Prize winning discoveries of Hounsfield and Cormack'. A decade later, with the improved CT scanner designs and the availability of new computer programs, it became possible to produce three-dimensional images from computed tomographic (CT) examinations).

Current models of CT scanners often incorporate the appropriate computer programs to produce the three dimensional images thus bypassing the need for extra hardware which was necessary in the earlier scanners. The technique involves selecting specific boundaries of the structure on the CT image. Successive narrow section images are then taken and the information from these scans is reassembled to produce a three-dimensional grey-scale image which may be viewed from different angles and in real-time rotation. More recently, new software has become available which enables the three-dimensional images to be viewed in colour enabling a clearer differentiation between soft tissue structures and bone.

Most of the initial studies on 3D CT scanning were performed on skeletal structures“. A large clinical experience has been obtained using this technique to evaluate craniofacial abnormalities. It is particularly useful to the maxillofacial surgeon in the management of facial trauma involving mandibular fractures and comminuted fractures of the midline of the face where reduction and internal fixation may be required.

Three dimensional CT has also been useful in the surgical assessment of complex shoulder trauma', acetabular fractures and spine problems.

In addition 3D quantitative CT has been useful in the assessment of bone changes of the rheumatic knee and may prove to be of value in the assessment of therapeutic procedures in patients with arthritis”. In children, congenital dislocation of the hip may be evaluated by 3D tomography“. A recent study suggests that the newly acquired technique of three dimensional reformating of magnetic resonance images may be superior to 3D CT alone in the demonstration of the cartilaginous femoral head”. Up till now we have dealt predominantly with imaging of the skeletal structures. 3D imaging is also proving useful in the abdominal viscera. Liver volumes may be evaluated“. This may prove of value in the assessment of metastatic disease and its response to treatment. The thoracic cavity can also be imaged producing high quality detailed 3D images of the lung surface and bronchial and vascular structures”. It is also possible to produce 3D images of aortic arch aneurysms“. Excellent 3D colour images of abdominal aortic aneurysms may also be obtained. Three dimensional imaging can also be applied to the brain. The Manchester group have studied the vascular relationships of tumours following the injection of contrast media'. They conclude that 3D reformated images were particularly useful in the assessment of pituitary tumours with large supra-sellar components or with possible bone destruction [1)].

1)

Banerjee AK, Higgins N. Three-dimensional computed tomographic scanning. J R Soc Med. 1990 Oct;83(10):607-8. PubMed PMID: 2286956; PubMed Central PMCID: PMC1292848.