AbstractID: 7249 Title: Reconstruction Methods for X-ray Helical (Spiral) C.T.

Data provided by a helical C.T. scanner need to be processed to obtain images in a format ready for medical diagnosis. This data processing is referred to as "image reconstruction".

To achieve image reconstruction in C.T., it is usually assumed that the data are integrals of the attenuation map of the body along different lines in space. With this simplified model, it is possible to design fast reconstruction methods leading to reliable images. The accuracy of the reconstruction is intimately linked to the data acquisition scheme. Different schemes go along with different information content and usually require different processing methods. In addition, different reconstruction approaches can lead to different outputs for a same set of data. This is particularly true in helical C.T. because the data set is in some way incomplete.

Recontruction methods in helical C.T. are based on the inversion of the so-called Radon transform. This inversion can be achieved in two ways. The first approach involves a resampling of the data in a parallel-beam mode matching the mathematical model of the Radon transform. The second approach involves a reformulation of the Radon inversion formula in the fan-beam geometry of the scanner data acquisition. Each approach has its pro and cons. In addition to these considerations, axial weighting of measured rays (180LI, 360LI, HE, HI) must be included in the reconstruction code to account for incompleteness of the helical-scan data set.

Educational objectives:

1. To understand the principles and fundamental differences of/between image reconstruction methods that use parallel-beam geometry and image reconstruction methods that use fan-beam geometry.

2. To understand why a helical data set is incomplete and how axial data weighting is used to circumvent the problem.

3. To understand the rationale behind popular weights such as 180LI, 360LI, HE, HI.

4. To identify the differences between reconstruction methods for single-slice (spiral) C.T. and multi-slice (spiral) C.T..