NUSU
Radiography and medical imaging sciences
3rd year
CT Technique

Technical parameters-1

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Technical parameters

- The quality of the image relates to the fidelity of the CT numbers and to the accurate reproduction of small difference in attenuation (low contrast resolution) and fine detail (spatial resolution) .
- Good imaging performance demands that image quality should be sufficient to meet the clinical requirement for the examination, whilst maintaining the dose to the patient at the lowest level that is reasonably practicable.

- In order to achieve this, there must be careful selection of technical parameters that control exposure of the patient and the display of the images, and also regular checking of scanner performance with measurement of physical image parameters as part of program of quality assurance.

Display and Exposure Parameters with an Influence on Image Quality and Dose

Nominal Slice Thickness

- The slice thickness in CT is a value selected by the operator according to the clinical requirement and generally lies in the range between 1 and 10 mm. In general, the larger the slice thickness, the greater the low contrast resolution in the image; the smaller the slice thickness, the greater the spatial resolution. If the slice thickness is large, the images can be affected by artifact, due to partial volume effects; if the slice thickness is small (e.g. 1-2 mm), the images may be significantly affected by noise.

Inter-slice Distance/Pitch Factor

- Inter-slice distance is defined as the couch increment (distance) between two slices. In helical CT the pitch factor is the ratio of the couch increment per rotation to the slice thickness at the axis of rotation. In clinical practice the inter-slice distance generally lies in the range between 2 and 10 mm, and the pitch factor between 1 and 2.

Volume of Investigation:

- Volume of investigation, or imaging volume, is the whole volume of the region under examination. It is defined by the outermost margins of the first and last examined slices or helical exposure. The extent of the volume of investigation depends on the clinical needs; in general the greater its value the higher the integral dose to the patient, unless an increased inter-slice distance or pitch factor is used.

Exposure Factors :

- are defined as the settings of X-ray tube voltage (kV), tube current (mA) and exposure time (s). In general, one to three values of tube voltage (in the range between 80 and 140 kV) can be selected. A high tube voltage is recommended for high resolution CT (HRCT) of the lungs and may be used for examination of osseous structures such as the spine, pelvis and shoulder. Soft tissue structures are usually best visualized using the standard tube voltage for the given equipment.

- Tube potential—80 to 140 kV
- •Voltage between the filaments and anode .
- •Higher potential accelerates electrons more.
- •Tube current—20 to 500 mA
- •Current flowing through the filament.
- Larger current produces more electrons and greater X-ray beam intensity.

Auto mAs option:

- Some manufacturers have provided this option were the machine automatically selects the optimum mA for a given slice without compromising the image quality resulting in reduced dose. Principle: This feature requires an AP/lateral scan to obtain information on the X-ray attenuation, so that the mA is increased automatically in areas of high X-ray attenuation.

Field of View:

- Field of view (FOV) is defined as the maximum diameter of the reconstructed image. Its value can be selected by the operator and generally lies in the range between 12 and 50 cm. The choice of a small FOV allows increased spatial resolution in the image, because the whole reconstruction matrix is used for a smaller region than is the case with a larger FOV.

Gantry Tilt:

- Gantry tilt is defined as the angle between the vertical plane and the plane containing the X-ray tube, the X-ray beam and the detector array. Its value normally lies in the range between -25° and +25°.

Reconstruction Matrix:

- Reconstruction matrix is the array of rows and columns of pixels in the reconstructed image, typically 512 ×512.

Reconstruction Algorithm:

- Reconstruction algorithm (filter, or kernel) is defined as the mathematical procedure used for the convolution of the attenuation profiles and the consequent reconstruction of the CT image.

Reconstruction Interval:

- Spiral slice displays data from a continuous data stream, that can be computationally manipulated to represent varying amounts of projections from adjacent slices. Thus, it is possible to reconstruct slices at intervals smaller than the fixed slice thickness. If reconstruction interval is small with a large acquisition pitch not much additional data can be obtained.

Window Level:

- Window level is expressed in HU and is defined as the central value of the window used for the display of the reconstructed CT image. It should be selected by the viewer according to the attenuation

Positioning and motion:

- Most CT examinations are carried out with the patient supine. In this position the patient is most comfortable with the knees flexed. Alternate positioning may be required to aid comfort and cooperation, for appropriate display of anatomy, to reduce absorbed radiation to particular organs, or to minimize artifact. Motion should be kept to a minimum to reduce artifacts; typical sources of artifacts are involuntary patient movement, respiration, cardiovascular action, peristalsis and swallowing.

Examination Technique Scanogram:

- A scanogram permits the examination to be planned and controlled accurately, and provides a record of the location of images. It is recommended that this is performed in all cases.

Any questions?