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Conebeam CT using C-arm mounted large area flat panels (FPs) is becoming more commonly used in neuro- and body-interventional suites. The ability to visualize vascular geometry in 3D along with soft tissue *during* an intervention is providing information that may increase accuracy, shorten procedure time and may even change the course of treatment. However, acquisition of the projection data required for volume imaging requires dose to the patient, and understanding the trade-offs between acquisition parameters, dose and image quality is critical to the appropriate adoption of this imaging technique.

Unlike conventional CT, the beam length in conebeam CT can cover the entire length of the object to be imaged or can be varied with the use of collimation, and the concept of CTDI is not, therefore, the metric of choice for measurement of dose. In addition, most C-arm conebeam CT systems use a short-scan (pi plus fan-angle) acquisition, and the dose distribution within the object is not cylindrically symmetric. Finally, since FP design has been optimized for fluoroscopy, image quality when used for CT must be carefully evaluated.

This lecture will describe a dose metric that is appropriate for conebeam CT and allows direct comparison with the CTDIw of conventional CT. A perception study using the CATPHAN 600 phantom for a range of acquisition parameters will be described, and the relationships between kVp, image noise, dose and contrast perception will be discussed.

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Educational Objectives:

1. Understand how differences in acquisition geometry between conebeam and conventional CT affect dose distribution and dose measurement.
2. Understand how contrast perception in conebeam CT images depends on acquisition parameters

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Questions:

#1 Which statement is true about dose:

a) in C-arm CT, collimation does not affect the dose measured at the central slice (ie. z=0, or in the plane defined by the path of the focal spot) of the imaged volume
b) CTDIw is defined as ½ the dose measured at the center of the phantom + ½ the average dose measured at the periphery of the phantom
c) in C-arm CT, the peripheral dose is higher on the x-ray tube side of the C-arm sweep
d) in C-arm CT, the average dose measured in the periphery of a 16-cm phantom is lower than the dose measured at the center of the phantom
e) CTDI100 represents the *angular average dose* at z=0 for a scan length of L=100 cm

#2 Which statement is true about low-contrast visibility

a) inherent object contrast increases with decreasing kVp
b) in C-arm CT head scans, better detectability occurs at higher kVp because the detector has been optimized for visualization of iodine-filled vessels
c) in signal detection theory, the signal-to-noise ratio is proportional to the square root of the signal area
d) the diameter of a 'just visible' object imaged at dose D1 can be scaled by $\sqrt{(D2/D1)}$ in order to obtain the equivalent 'just visible' diameter of the object at dose D2