The Operating Console

Computed tomography imaging systems can be equipped with ***two or three consoles***.

- One console is used by the ***CT radiologic technologist*** to ***operate the imaging system***.
- Another console may be available for a technologist ***to post process images to annotate patient data on the image*** (e.g., hospital identification, name, patient number, age, gender) and ***to provide identification for each image*** (e.g., number, technique and couch position). The second monitor also ***allows the operator to view the resulting image before transferring it to the physician's viewing console***.
- A third console maybe available ***for the physician to view the images and manipulate image contrast, size, and general visual appearance***. This is in addition to several remote imaging stations available to the radiologist and other physicians.

The operating console ***contains meters and controls*** for selection of proper imaging *technique factors, for proper mechanical movement of the gantry and the patient couch, and for the use of computer commands that allow image reconstruction and transfer*.

The physician's viewing console accepts the reconstructed image from the operator's console and displays it for viewing and diagnosis.



A typical operating console contains controls and monitors for the various technique factors. Operation is usually in excess of 120 kVp.

The maximum mA is usually 400 mA and is modulated (varied) during imaging according to patient thickness to minimize the patient radiation dose.

Patient Table or Couch

The patient table is an important and highly integrated component of the CT scanner. The ***CT computer controls table motion*** using precision motors with telemetric feedback, for patient positioning and CT scanning. This is ***critically important in helical scanning where the coordination of tube rotation and table movement is essential***. The patient table (or couch) can be retracted from the bore of the CT gantry and lowered to sitting height to allow the patient to comfortably get on the table, ***usually in the supine position*** as shown in Figure 1.

Under the CT technologist's control, ***the system then moves the table upward and inserts the table with the patient into the bore of the scanner***. A series of ***laser lights provide references in multiple directions to allow the patient to be centered in the bore*** (both laterally and in terms of table height) and to adjust the patient longitudinally, as mentioned in the previous lecture.

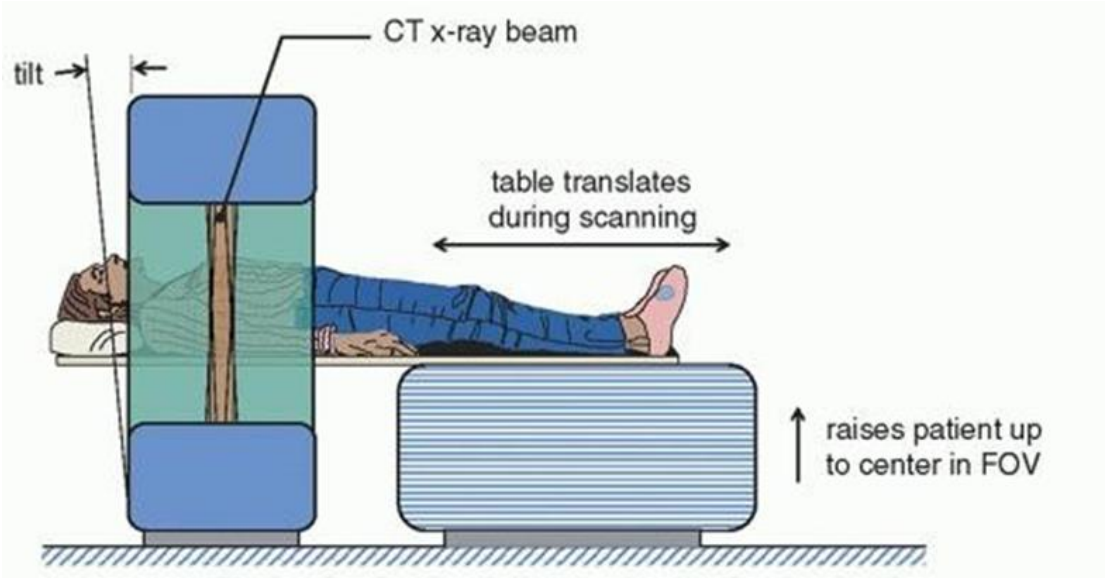


Fig. (1): The patient table is a perfunctory but surprisingly high-tech component of a CT scanner. The ***patient table lowers to sitting height to allow patients***—including the elderly and physically impaired—to sit on the table and reposition to ***a prone or supine position***, with help from the attending technologist.

Image Display, Storage, and Communication

The ***third and final step in the CT process involves image display, storage, and communication***. After the CT image has been reconstructed, it ***exits the computer in digital form***. This must be ***converted to a form that is suitable for viewing and meaningful to the observer***.

Display Device

The ***grayscale image is displayed on a television monitor*** (Cathode ray tube [CRT]) or liquid crystal display, which is an essential component of the control or viewing console. In the display and ***manipulation of grayscale images for diagnosis, it is important to optimize image fidelity*** (i.e., the faithfulness with which the device can display the image). This is influenced by physical characteristics such as ***luminance, resolution, noise, and dynamic range***.

Resolution: ***is an important physical parameter of the grayscale display monitor and is related to the size of the pixel matrix, or matrix size***. The display matrix can range from 64×64 to 1024×1024, high-performance monitors display image with 2048×2048 matrix.

Windowing

Because the ***human eye cannot distinguish all of the possible 5,000–10,000 shades of gray***, the grayscale of the CT image is ***limited to be composed of a range of (+1000 to −1000)*** that represent varying shades of gray, that appreciated to the human eye.

The process of ***limiting the number of shades*** of gray presented on the CT image to ***optimize viewing by the human eye is called windowing***. In other words, windowing is a term used to refer to ***the fine adjustments made in the image on the computer screen to enhance viewing and emphasize various tissues of interest***. Windowing is ***performed by the reader at the workstation*** (are located on the control console) ***after the image is obtained, reconstructed and transferred to the viewing workstation***.

The specific number of shades of grey chosen for presentation the CT image's on the compressed scale is called the window width (WW) and artificially defines the number of shades of grey presented to the viewer; (controls the CT image contrast).

While the ***window level (WL) is defined as the center or midpoint of the CT number range that composes a CT image's gray scale***; (controls the CT image brightness).

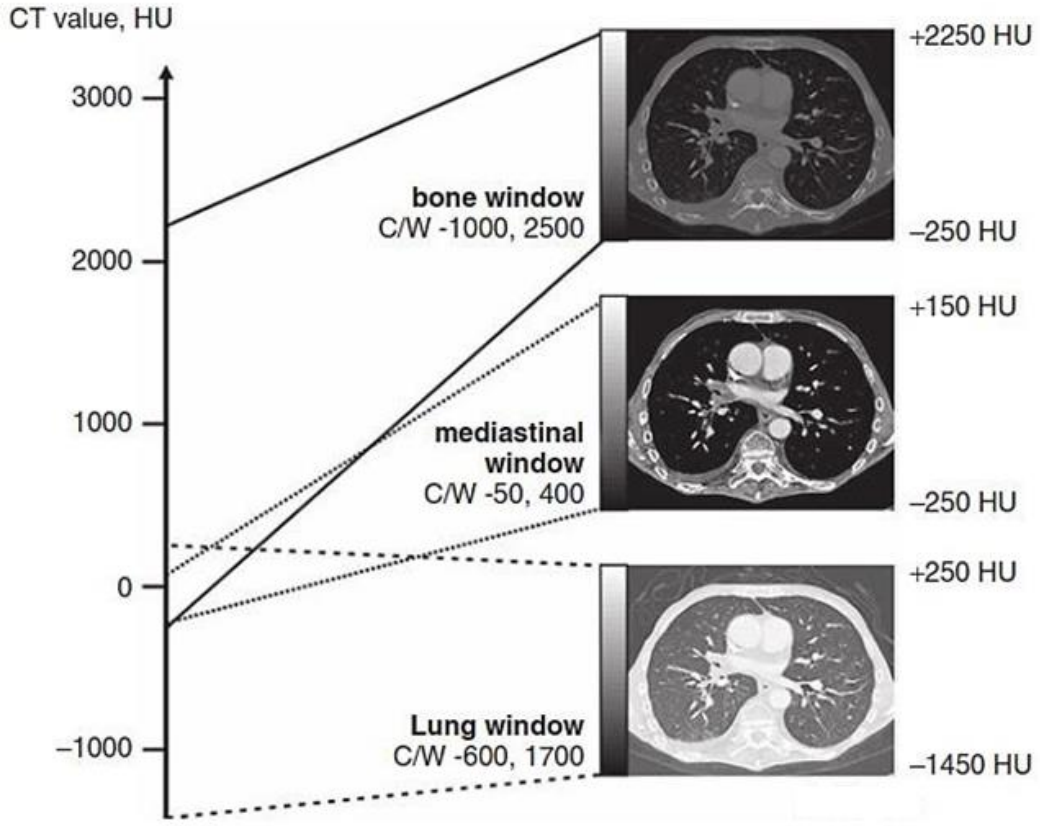


Fig. 2: Windowing is a digital image post-processing operation intended to alter the image contrast (a function of the WW) and the image brightness (a function of the window center, C, or WL, as it is often referred).

The image contrast is optimized for the anatomy under study; therefore, ***specified values of WW and WL or C must be used during the initial scanning of the patient***.

Note that in (Figure 2), three windows are shown: the ***bone window*** (optimized for imaging bone), the ***mediastinal window*** (optimized for imaging the mediastinal structures), and the ***lung window*** (optimized for imaging the lungs).