

75 Field of View: Rectangular

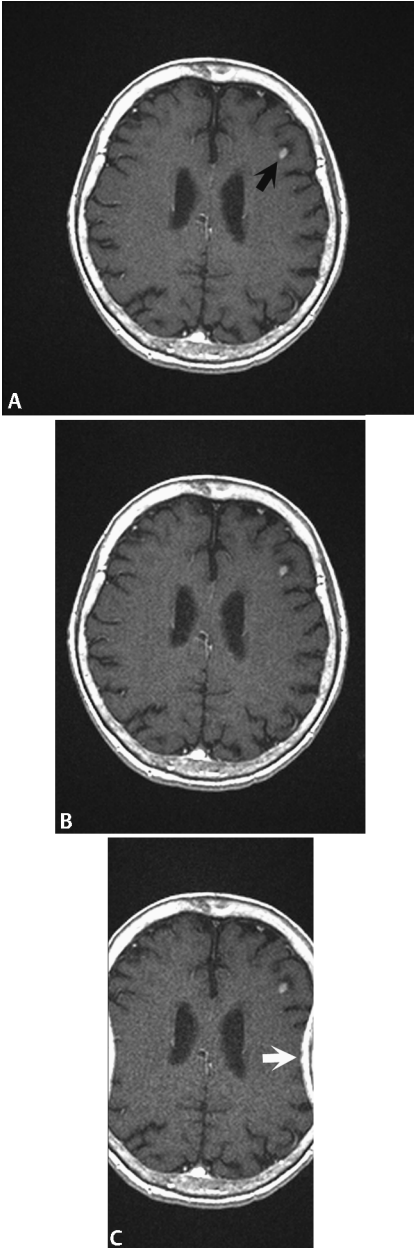


Fig. 75.1

The field of view (FOV) defines the part of the patient to be imaged. This is chosen prior to scan acquisition and need not be square. Indeed, under certain circumstances, a reduced FOV along one axis can be advantageous. The topic of this case is the choice of the FOV in the phase-encoding direction.

In **Fig. 75.1**, the FOV in the phase-encoding direction (right to left in this instance) was changed from 100% (**Fig. 75.1A**) to 75% (**Fig. 75.1B**) to 50% (**Fig. 75.1C**). A small enhancing left frontal metastasis is illustrated (black arrow, **Fig. 75.1A**) on postcontrast T1-weighted scans. Images are displayed as acquired, without cropping or differential magnification. Because the pixel size was held constant, fewer phase-encoding steps were required for **Fig. 75.1B** (three-fourths the number) and **Fig. 75.1C** (one-half the number). Scan time is directly proportional to the number of phase-encoding steps, and so the scan time of **Fig. 75.1B** was three-fourths that of **Fig. 75.1A**, and that for **Fig. 75.1C**, one-half that of **Fig. 75.1A**. However, as illustrated, there are two potential problems associated with using this approach, also termed a *rectangular* FOV. The first problem is the wraparound (aliasing) artifact. If the part of the patient being scanned extends beyond the FOV in the phase-encoding direction, that part will appear superimposed on the image on the other side. Thus in **Fig. 75.1C**, the right part of the head appears superimposed over the (anatomic) left side of the image (white arrow), and the left part of the head over the right side of the image. The second problem is reduced SNR. Using fewer phase-encoding steps (p) leads to lower SNR ($\text{SNR} \propto \sqrt{p}$). SNR decreased from (a relative value of) 1 in **Fig. 75.1A** to 0.87 in **Fig. 75.1B** to 0.71 in **Fig. 75.1C**. The loss in SNR



Fig. 75.2

due to halving the FOV in the phase-encoding direction, could be compensated by doubling the number of acquisitions (averages), but then the two scans would have the same acquisition time.

Figure 75.2 compares similarly magnified parts of (top) **Fig. 75.1A** to (bottom) **Fig. 75.1C** to illustrate better the SNR loss. The increased graininess of the image on the bottom is due to its lower SNR. Note that if the area of interest is near to the center of the FOV, then some image wrap can be tolerated. In this instance, however, wraparound is still evident (white arrow) on the rectangular FOV image, despite the magnification and cropping employed.

A rectangular FOV is commonly used in axial head imaging (without changing the number of averages), decreasing scan time with only a minimal reduction in SNR. **Figure 75.1B** is an example of this application, with the FOV in the phase-encoding direction chosen to closely match the dimension of the head (right to left). A rectangular FOV finds similar application in imaging of other body parts that have a reduced width in one dimension (such as the wrist on axial imaging). It should be noted that in the preceding discussion, the pixel size has been assumed to be square. This need not be the case, and the shape of the pixel can be varied together with the

FOV, thus also influencing spatial resolution along one axis. With modern MR scanners, the increment by which the FOV, the number of phase-encoding steps, and the number of readout steps can be changed is almost unlimited.

In reference to aliasing, with the scanners delivered today, this phenomenon is restricted to the phase-encoding direction. Aliasing in the readout (frequency-encoding) direction, although a problem in the past (and countered by oversampling), is no longer an issue.