27 Calculating T1 and T2 Relaxation Times (Calculated Images)

The classification of lesions based on their hypointense or hyperintense appearance is hampered by the influence of field strength and pulse sequence parameters. An alternative approach (but little used today clinically) is to calculate tissue relaxation times, thus providing a quantitative means of lesion characterization. Inversion recovery (IR) imaging techniques are considered to be the most accurate for calculation of T1 relaxation times. A simple means of estimating T1 can be achieved by acquiring two images with different inversion times, in this example, 350 and 550 msec (**Fig. 27.1**). The T1 value is then calculated based on these two points measured along the recovery path of the longitudinal magnetization. The resultant "calculated" image is displayed at the bottom of **Fig. 27.1**. In this image, the value of each pixel corresponds to the T1 of the respective tissue (a quantitative measure), as opposed to signal intensity (a qualitative or relative measure) as with the majority of MR images.

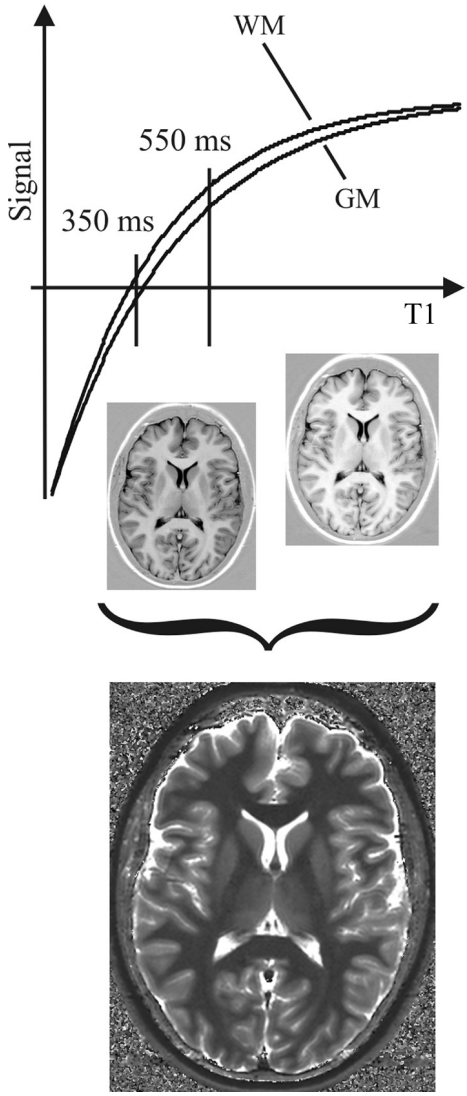

Fig. 27.1

An alternative approach to the use of inversion recovery imaging is the acquisition of spin echo images with different T1-weighting (different repetition times, 550 and 950 msec in this instance). Based on the difference in signal intensity between the two acquisitions, the T1 value of the tissue can be estimated. It is important, however, that the change in signal intensity as a function of TR is well above the noise level of the image; otherwise, the calculated T1 image will be very noisy (as illustrated in **Fig. 27.2**).

T2 relaxation times can be estimated from a single multi-echo spin echo measurement, where the echo

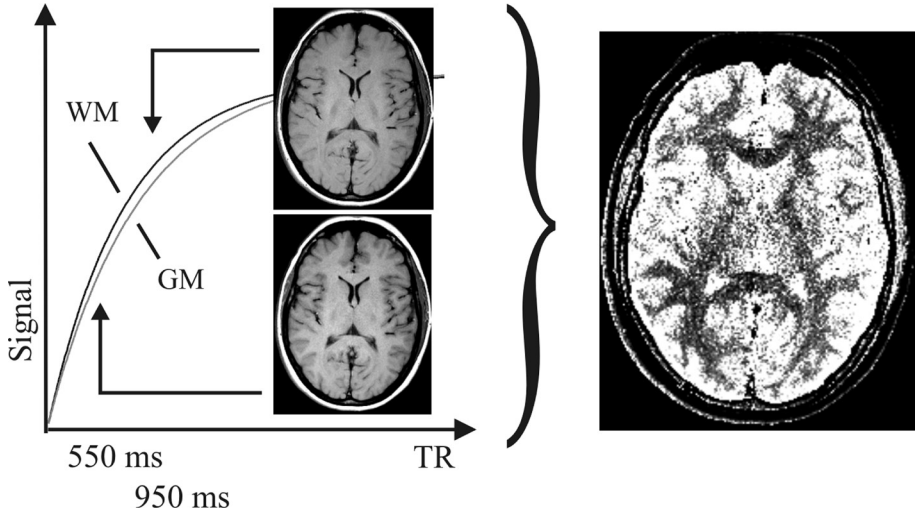

Fig. 27.2

time–dependent signal decay follows the T2 relaxation time of the tissue. In **Fig. 27.3**, three images with different echo times (TE) were acquired in a single multiecho scan. The change in signal intensity as a function of echo time is then used to generate a T2 pixel map, the final image shown in **Fig. 27.3**.

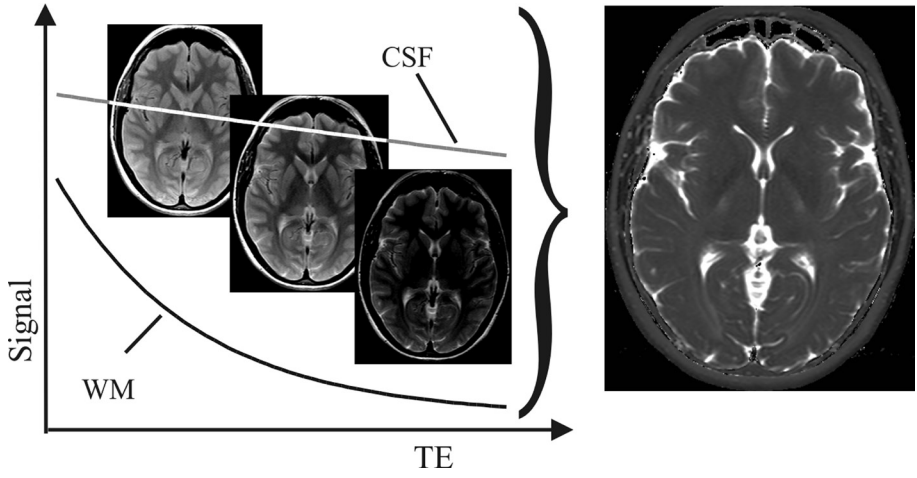

Fig. 27.3