The advent of new MRI techniques such as perfusion- (PWI) and diffusion- (DWI) weighted imaging in the early 1990s has added another dimension to diagnostic imaging in stroke [98, 195, 224, 236, 237, 372]. During the last few years a growing body of evidence has accumulated, documenting the usefulness of this method in the clinical setting of acute ischemic stroke. Several investigators found a significant correlation of DWI and PWI changes with follow-up imaging as well as with neurological outcome [18, 205, 322, 344, 371, 373]. Some authors concluded that different infarct patterns can be identified by means of DWI and PWI in hyperacute stroke, which may allow a more rational selection of therapeutic strategies based on the presence or absence of a tissue at risk. Nevertheless, substantial doubts remain regarding the feasibility and practicality as well as the validity of stroke MRI in the clinical setting [268, 397]. In this chapter we discuss the logistic problems that may arise, including solution paths, when this novel methodology is implemented in the clinical routine. Good logistics are the basis for a time efficient diagnosis and treatment process of a stroke patient.

A dedicated stroke service with multimodal imaging availability around the clock (CT, MRI, DSA) requires a sufficiently large staff, infrastructure such as a stroke service, stroke or neurocritical care unit and short distances between emergency room, stroke unit and imaging facilities to save time. At our institution in Heidelberg, for instance, the routine call schedule implies the presence of at least 3 neurology fellows or residents (1 neurintensivist, 1 emergency room neurologist, 1 stroke unit neurologist), 1 neuroradiologist and 1 MR technologist at all times. The MR technologists are familiar with the procedure of stroke MRI, because DWI and PWI are also used in other areas of neuroimaging such as multiple sclerosis and brain tumors [17, 142]. All neuroradiologists have been trained in the use and interpretation of stroke MRI findings. As soon as hyperacute stroke patients are admitted to the emergency room, the neuroradiologist and technician are informed and thus can prepare the infusion pump for PWI as well as the MR scanner while the screening exam, history and stabilization of vital parameters are being performed. Depending on institutional and/or research protocols, CT is also performed (facultatively with CTA and PCT) for, e.g., comparative studies. Ideally, during the day, the patient is directly moved from the CT to the MRI suite or vice versa, which optimally should be next to each other. A CT or MRI examination underway should not be interrupted if only a brief time is needed to finalize the imaging protocol. However, there should be no unnecessary delays in the diagnostic workup as time is of essence in acute stroke patients. At night, when there are no routine MRI procedures being performed, there are no waiting times expected. If there should be a small delay, this can be used to prepare the patient and setup all the monitoring or introduce additional i.v. lines that may be needed. Before being transferred into the MRI suite, the patient and personnel must be checked (check themselves) for any metallic devices in or on his/her body such as surgical scars after pacemaker implantation, coins, piercings, watches, jewelry or others.

At first adequate monitoring has to be performed in the MRI scanner and therefore the treating neurologist or stroke fellow should accompany and care for the patient while the (neuro-) radiologist acquires the scans (Fig. 8.1). Stroke patients should receive 4–8 l O₂ via nasal prongs and the patient’s oxygen sat-
uration and ECG should be monitored continuously. If the patient's blood pressure is unstable, the BP can be measured intermittently. All of these monitoring techniques are available as a diagnostic standard in MRI suites. Two aspects with regard to imaging quality of stroke MRI are a major concern, i.e., motion artifacts and noise. Stroke patients can be agitated and restless due to disorientation and aphasia. This, in general, is more pronounced in the more severe stroke patients. Therefore, noise reduction may also help to reduce patient movements. Ear plugs can effectively reduce patient irritation from noise, especially with the EPI sequences. Furthermore, the patient's head can be immobilized with pieces of foam rubber (5''x2''x8''), which are stuffed between the head coil and the head on both sides, thus, also adding to the noise reduction achieved by the ear plugs. When the head is immobilized, movement of the non-paretic leg does not influence image quality. Sometimes it may become necessary for the accompanying neurologist to firmly hold the patient's non-paretic hand, because uncooperative patients frequently place it on or into the head coil. When necessary, mild sedation can be given with either propofole 20–60 mg/h continuously i.v. or midazolam 5–10 mg as an i.v. bolus, repeatedly if necessary. In our experience, however, sedation is generally not necessary. A complete stroke MRI protocol should be comprised of DWI, PWI, MRA, T2-WI and T2*W. The net imaging time for a similar protocol is 10 to 15 minutes at maximum and an additional 5 to 10 minutes are necessary for patient positioning and transfer. Calculation of the ADC- and MTT/TTP/CBF-maps should be performed automatically by customized software.

In a pilot study we prospectively recruited acute stroke patients in the 12 h time window for stroke MRI scanning for 2 years (1997–1999) [308]. The basic protocol was designed to identify patients, who are suitable for specific forms of therapy within the first hours of stroke. We included patients with an ischemic stroke within the last 12 hours and a baseline NIHSS score of at least 3, but preferred a time window of 6 hours after symptom onset. Stroke onset in general is defined as the last time the patient was known to be without neurological deficit. All patients had a CT scan before they were enrolled into the MRI study and if thrombolysis was performed this was done with 0.9 mg/kg BW rt-PA in eligible patients with a 6 h time window according to the ECASS II study protocol [126]. To prevent selection bias, the indication for thrombolysis was based exclusively on clinical status and CT findings, not on stroke MRI results. CT was followed by stroke MRI, after which the patient was admitted to the neurocritical care unit, or to the stroke unit for further monitoring and therapy. We exam-