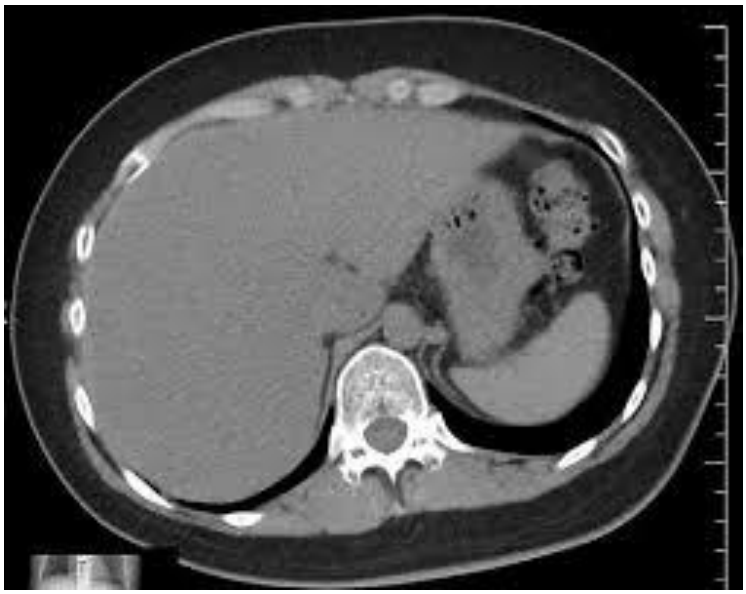
KREP

2025

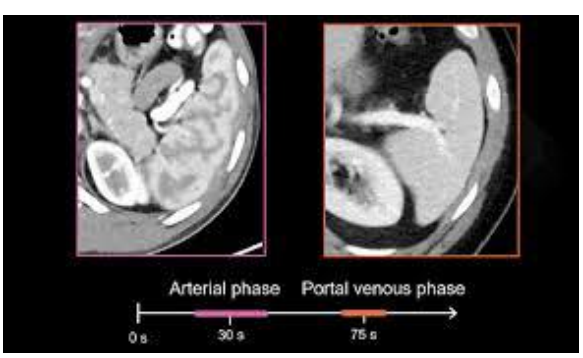
## KARNATAKA RADIOLOGY EDUCATION PROGRAM

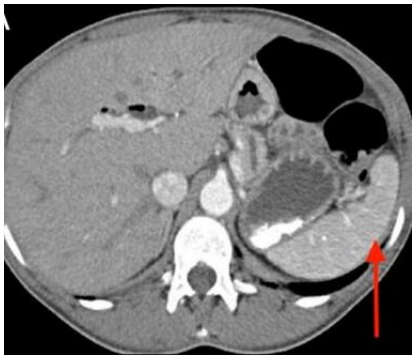
## Spleen Anatomy and Applied Radiology – 3

**Computed tomography (CT) is 1 of the major modalities for evaluating the spleen and ultrasound. The normal spleen measures approximately 40 to 60 Hounsfield units (HU) on unenhanced CT, about 10 HU less than the liver. On unenhanced CT, the examiner can easily appreciate splenic calcifications.**



**On an enhanced CT, the spleen demonstrates a serpentine, cordlike, irregular enhancement pattern in the arterial phase (approximately 30 seconds after intravenous contrast injection) due to an open circulatory system in the red pulp. On portal venous phase imaging (60 seconds after intravenous contrast injection), the spleen enhances homogenously since the contrast opacifies both the red and white pulp contrast opacifies both the red and white pulp.**




**Late arterial phase**

**The normal signal of the adult spleen on MRI is hyperintense on T2-weighted imaging and hypointense on T1-weighted imaging relative to the liver.**

**Indications**

**There are no established indications for MRI of the spleen because ultrasound and CT allow excellent diagnostic evaluation of this organ. Relative indications for MRI exist in the staging of lymphoproliferative disease (Hodgkin and non-Hodgkin lymphoma) and characterization of focal splenic lesions. MRI is also a suitable imaging modality for planning infradiaphragmatic radiotherapy in patients with lymphoproliferative disease as coronal sequences give an excellent overview of the vascular anatomy in the splenic hilum. Another relative indication is the follow-up of posttraumatic splenic hematoma in pediatric patients with inconclusive sonographic findings after nonsurgical treatment.**

**Imaging Technique**

**Before the examination, the patient is given a general explanation of the procedure (e. g., duration of breath-holds) including information about placement of an intravenous line for contrast injection–either Gd-based extracellular contrast medium or SPIO particles (superparamagnetic iron oxide)–and the need for administering an antispasmodic drug (e. g., butylscopolamine or glucagon). Oral contrast is not required for MRI examinations of the spleen. Coil selection depends on the equipment available (e. g., torso or body phased-array coil). Scanning is performed with the splenic hilum in the isocenter of the magnet. To this end, the patient is positioned supine with the alignment light of the scanner centered at the level of the xiphoid process.**

**Imaging Planes**

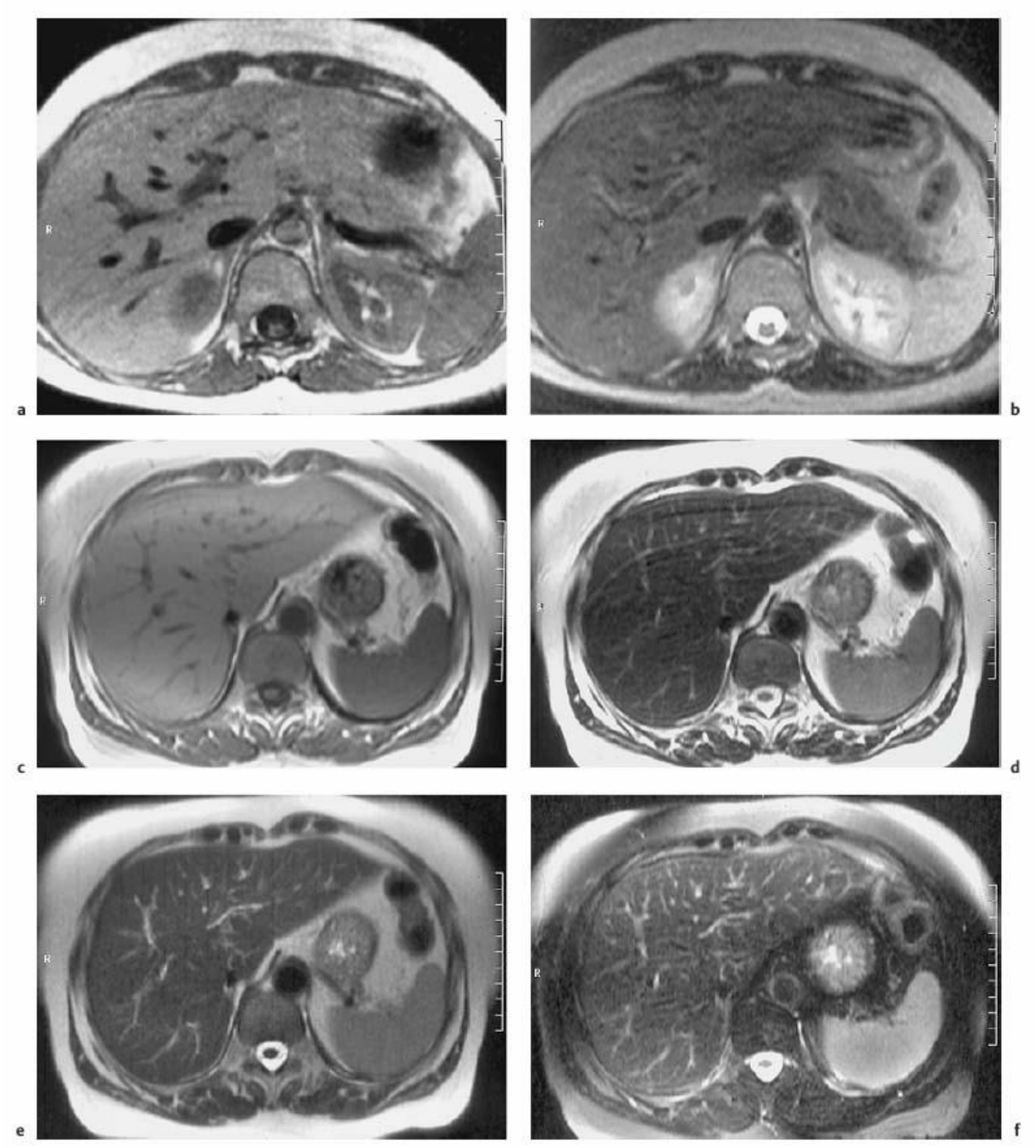
**The axial plane is the backbone of a dedicated examination of the spleen (Fig. 4.1). Additional coronal imaging is helpful if the patient's breath-hold capacity and the MR equipment allow acquisition of good-quality images during breath-hold (Fig. 4.2). The spleen is imaged with a slice thickness of 6–8 mm and an interslice gap of 2 mm.**

**Pulse Sequences**

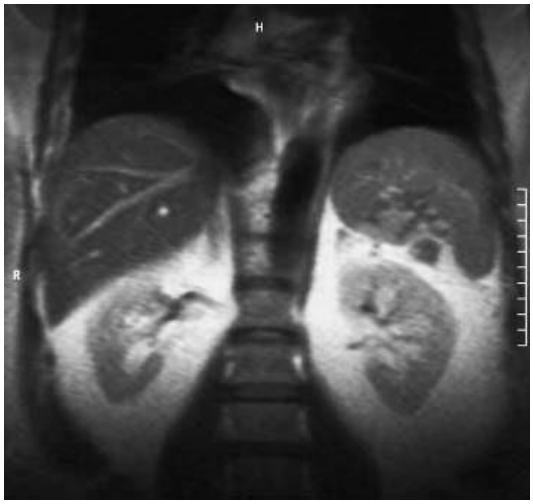
**The basic protocol consists of unenhanced T1w and T2w sequences. T1w images are acquired with an SE or TSE sequence but preferably with a 2D GRE sequence during breath-hold. All of these sequences are acquired with the shortest possible TE to optimize image contrast. Unenhanced T2w imaging is performed with a breath-hold single-shot TSE sequence (e. g., HASTE). Because these 2D sequences have short acquisition times, basic imaging in the axial plane can be supplemented by a coronal sequence, or even sagittal images if needed, with only a minimum of additional time. A free-breathing TSE sequence with fat suppression (e. g., inversion recovery technique, spectral fat saturation) may improve image quality but takes longer to acquire. The image quality of free-breathing T2w sequences can be improved by using respiratory gating (respiratory bellows, navigator echo technique), which will markedly reduce motion artifacts.**

**Contrast Media**

**Intravenous bolus injection of extracellular Gd-based contrast medium (e. g., Magnevist, Dotarem) with dynamic acquisition of serial contrast-enhanced T1w images is recommended to detect and characterize focal lesions in the spleen. The dynamic images are acquired with a GRE sequence during breath-holds before and 15 s, 45 s, 90 s, and ca. 3 min after injection of the contrast medium at a dose of 0.1 mmol Gd per kg body weight. Immediate postcontrast T1w GRE images allow sensitive detection of focal splenic lesions3,4 (Fig. 4.3). Additional late postcontrast images should be acquired after ca. 6–10 min using a fat-suppressed SE or TSE sequence or fat-suppressed GRE sequence. Alternatively, the dynamic T1w series can be acquired with a 3D GRE sequence (e. g., VIBE), which has higher spatial resolution and produces an angiographic effect while slightly reducing soft tissue contrast.**



**a–f Normal MR appearance of the spleen at 0.2 T (a, b) and 1.5 T (c–f). a, b At 0.2 T, the spleen has lower SI than the liver on T1w image (SE 450/15) (a), while it is hyperintense on T2w image (FSE 3000/102; turbo factor,13) (b). A solid tumor of low SI is seen in the upper pole of the right kidney. c, d At 1.5 T, the spleen is again hypointense to the liver on T1w image (GRE 126/5;75°) (c) and hyperintense on T2w image (FSE 2000/128; turbo factor,23) (d). e On T2w HASTE image, the SI difference between spleen and liver is less pronounced (HASTE ∞/90). f On fat-suppressed T2w image, the spleen has markedly higher SI than the liver (FSE 2000/128; turbo factor,23).**




**Coronal T2w image acquired with HASTE sequence at 1.0 T (HASTE ∞/43). Using this technique, the normal spleen is nearly isointense to liver. Bowel is seen in the splenic hilum.**

**Recommended sequences for Spleen MRI**

| | Sequence | Plane | Breath-hold | Indication |
|---|---|---|---|---|
| a) | T1w GRE | Axial | Yes | Basic protocol |
| b) | T2w HASTE | Axial | Yes | Basic protocol |
| c) | T2w TSE -/+ fat suppression, may be performed with respiratory gating | Axial | No | Basic protocol; improves image quality compared with (b) |
| Optional | T1w GRE with dynamic Gd-enhanced series with delayed images | Axial | Yes | (Suspected) focal lesion |
| Optional | T1w SE or TSE | Axial | No | If (a) not possible |
| Optional | TIRM | Axial | No | If (c) not possible |
| d) | Post-Gd T1w GRE | Axial | Yes | Basic protocol |
| Optional | Post-Gd T1w GRE + fat saturation | Axial | Yes | For example in patients with extrasplenic disease extension or suspected pathology of surrounding structures |
| Optional | Post-SPIO T2w HASTE, TSE | Axial | No | Improved characterization of focal and diffuse changes |

**Note:** Axial images can be replaced or supplemented by other planes (primarily coronal) depending on the anatomic situation.

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https://radiologykey.com/ , **Spleen Imaging, William Coffey; Rashmi Balasubramanya.**