Regenerative and Dysplastic Nodules

- Localized proliferation of liver parenchyma within cirrhotic liver in response to liver injury
- May progress to become dysplastic or malignant.
- Abbreviations
  - Dysplastic nodule (DN)
  - Regenerative nodule (RN)
- Synonyms
  - Cirrhotic nodule
- RNs are benign, but some progress to become dysplastic
- High-grade DNs are premalignant, but rate of transformation is slow

Imaging

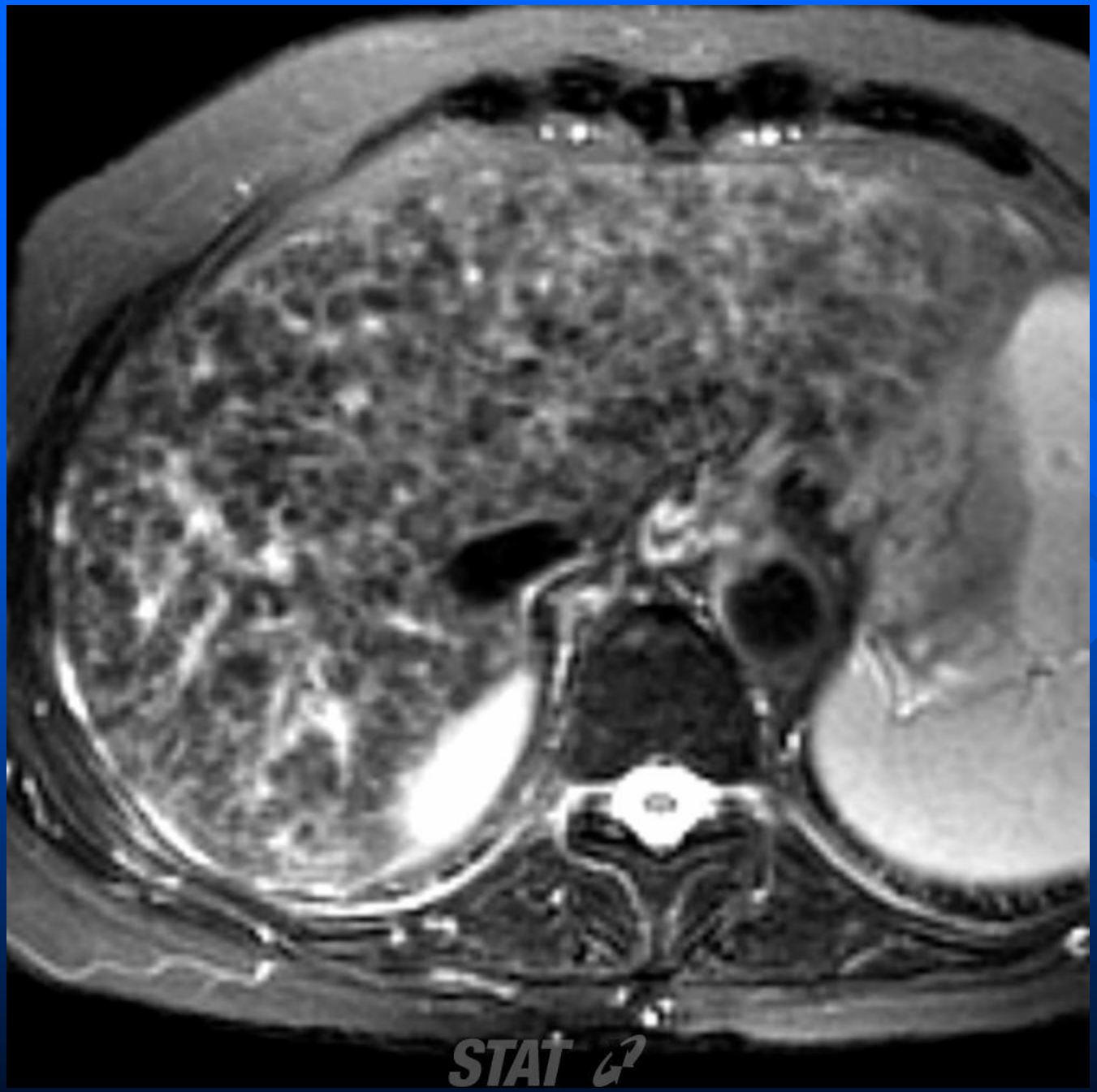
- Regenerative nodules (RNs): Multiple nodules in cirrhotic liver with decreased signal intensity on T2WI or GRE
  - Commonly < 2 cm, usually not seen on CECT or T1WI MR
  - Hyperattenuating to liver on NECT; hypointense on T2WI + GRE; take up and retain gadoxetate (Eovist)
- Dysplastic nodules (DNs): Fewer, larger, hyperintense on T1WI and hypointense on T2WI
  - Usually 2-4 cm in diameter
  - Should not be hypervascular (raises concern for hepatocellular carcinoma [HCC])
  - High-grade DNs and HCC lack functioning hepatocytes and biliary excretion; → no uptake of hepatobiliary MR contrast agents
  - RNs and low-grade DNs show no restricted diffusion (= not bright) on DWI

MRI

- **T1WI**
  - RNs
    - Variable signal intensity
    - Usually isointense to liver (undetected)
  - DNs
    - Variable signal intensity
    - Usually iso- to hyperintense to liver
- **T2WI**
  - RNs
    - ↓ signal intensity compared to liver (due to iron content)
  - DNs
    - Low-grade nodules tend to have lower signal intensity compared to liver
    - High-grade nodules tend to have slightly higher signal intensity compared to liver
      - ↑ signal intensity corresponds to ↑ dedifferentiation and concern for HCC
- **T2* GRE**
  - RNs: ↓↓ signal intensity compared to liver
    - "**Blooming**" (appearing larger) due to ↑ susceptibility effect of iron
- **DWI**
  - RNs and low-grade DNs show no restricted diffusion (= not bright) on DWI
  - High-grade DNs and HCC are usually bright on DWI
- **T1WI C+**
  - RNs
    - Isointense to liver (undetected) or slightly hypointense
  - DNs
    - Variably hyperintense to adjacent liver
      - Increasing vascularity increases concern for malignant degeneration of DN
- MR with gadobenate dimeglumine or gadoxetate: Avid uptake and retention in RNs and DNs
  - Indicates functioning hepatocytes
  - Favors benign etiology (RN)
    - High-grade DNs and HCC lack functioning hepatocytes and biliary excretion
      - → no uptake (hypointense on delayed imaging)

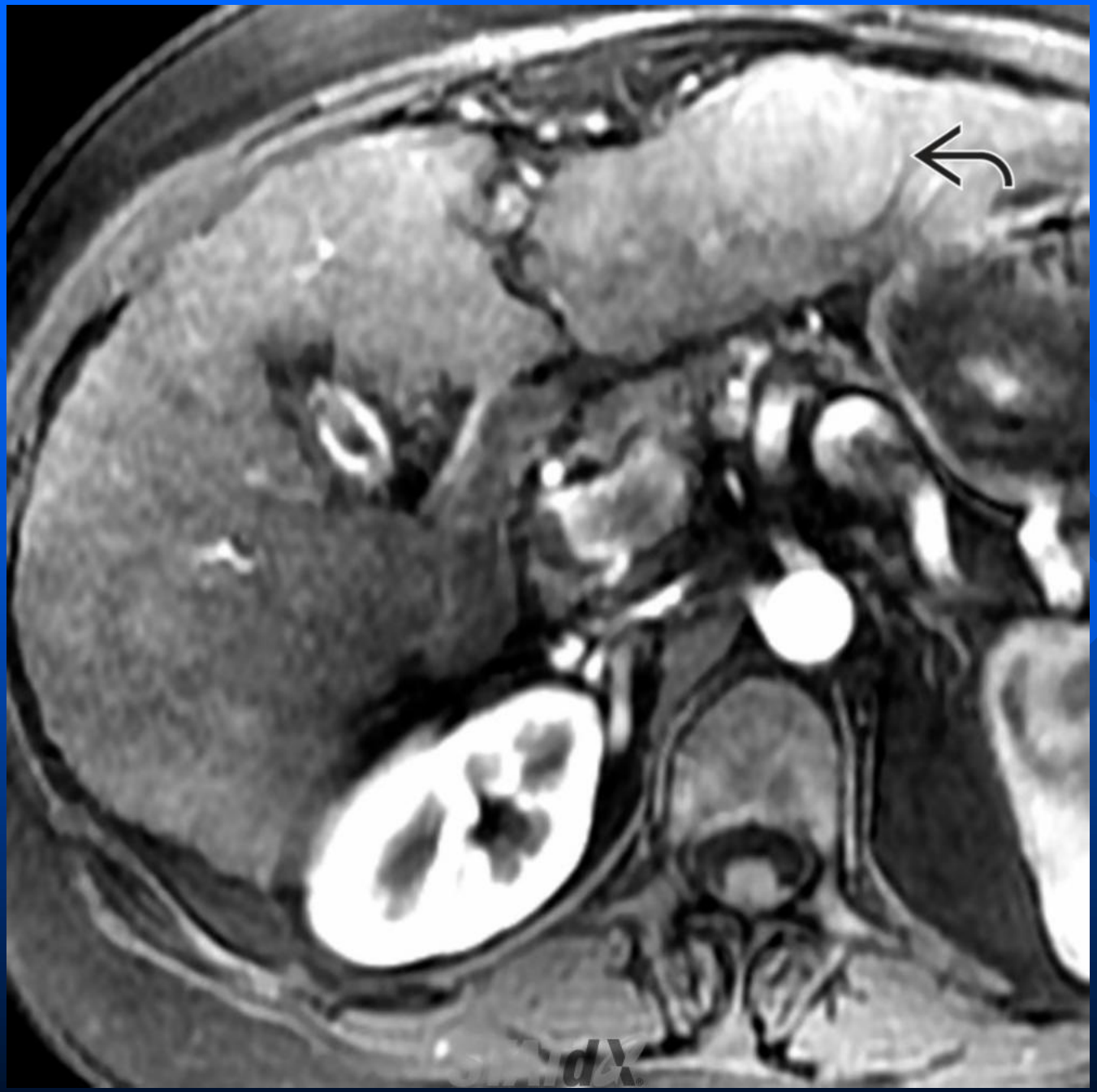
HCC / Dyplastic nodules

- **Dyplastic nodules** are dark on T2 iso to increased on T1
- **HCC** is bright on T2, will show early ehnhancement with rapid wash out with peripheral rim of enhancement on delayed images
- **Greater than 3 cm will invade portal**

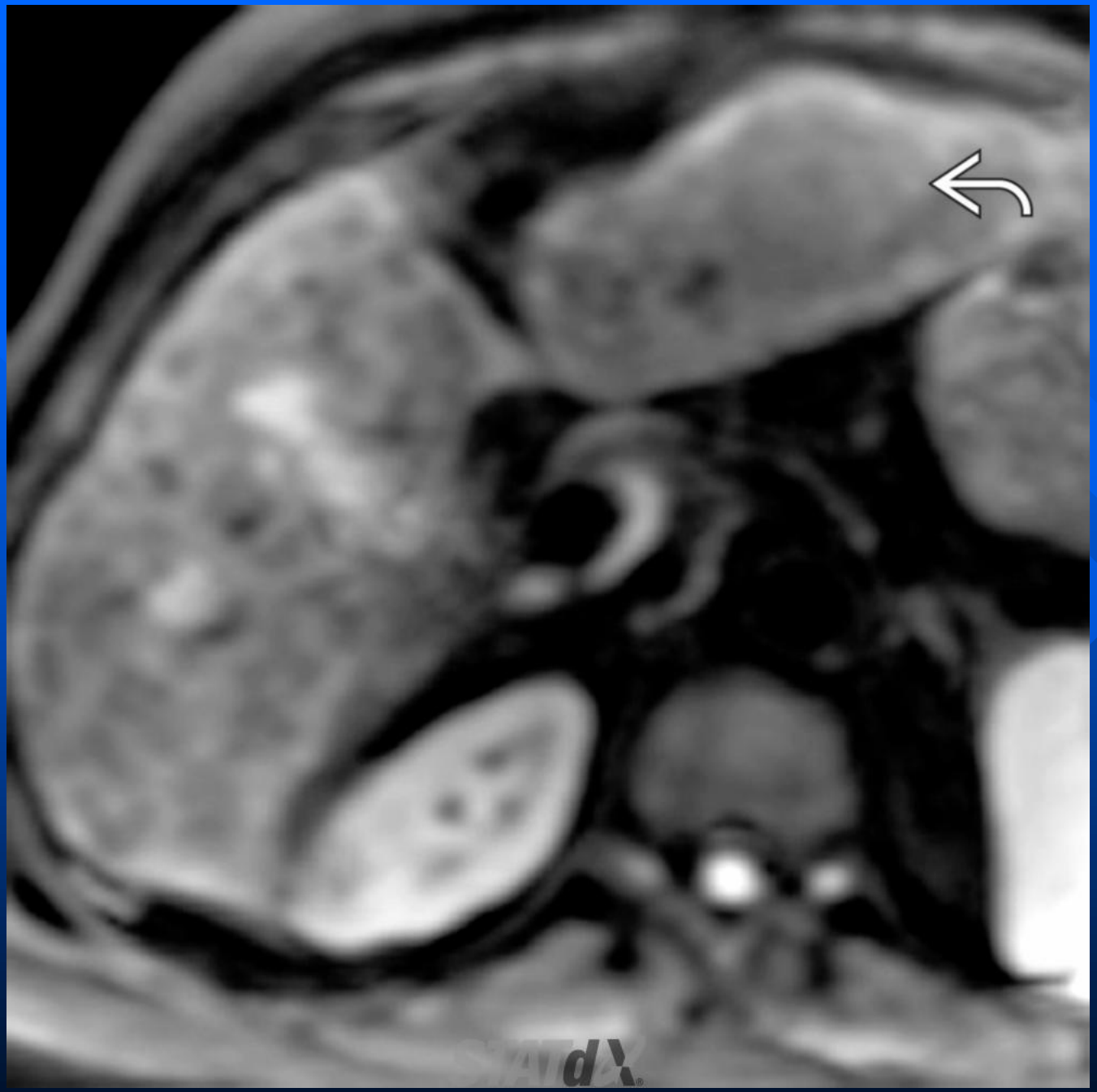


T2WI MR shows innumerable subcentimeter hypointense nodules that are typical of cirrhotic regenerative nodules. MR sequences that best show regenerative nodules are the T2WI and GRE series.

Axial T1WI MR in the same patient shows a well-defined hyperintense lesion in the lateral segment that proved to be a dysplastic nodule (white curved arrow).



Axial contrast-enhanced T1WI MR in the arterial phase shows minimal enhancement of the dysplastic nodule (black curved arrow), a characteristic appearance of this lesion.



Axial diffusion-weighted image in the same patient shows no restricted diffusion (bright signal) within the dysplastic nodule (white curved arrow).