

### Outline: Artifact Identification, Cause, How to Fix

- Motion / ghosting
- Flow
- Aliasing / wrap
- Radiofrequency interference
- Metal
- Corduroy

# Motion / Ghosting Identification: May appear as repetition of "ghosts" across image, may be distinct or blurred depending on type of motion. Typically occurs in phase encoding direction Causes: Patient motion, physiologic / involuntary, voluntary; equipment vibration / instability













# Propeller / Blade

- Reduce sensitivity to motion
- May be used for uncooperative patients

Pipe, Magn. Reson. Med. 1999; 42:963-969







# Motion / ghosting

- How to fix:
  - Remind patient to hold still, make patient more comfortable, decrease scan time, consider sedation
  - Use respiratory triggering / navigator pulses, motion correction, breath-hold options when available
  - Implement Propeller / Blade sequence options
  - Address equipment problems, test with phantom, test with cold-head off
  - Swap phase and frequency if artifact obscures pathology

## Flow

- Identification:
  - Ghosting, appears as repetition (phase encoding direction) of blood
- Causes:
  - Velocity induced phase effects











## Flow

- How to fix:
  - Gradient moment nulling / flow compensation
  - Spatial saturation bands
  - Swap phase and frequency if artifact mimics pathology

# Aliasing / wrap

- Identification:
  - Patient anatomy appears in incorrect locations
- Causes:
  - Insufficient sampling
  - Small FOV with anatomy (signal) outside FOV











# Aliasing / wrap

- How to fix:
  - Increase FOV
  - Increase over-sampling in phase encoding and / or slice directions (for 3D)
  - Use saturation bands for anatomy outside FOV
  - Turn off coils outside imaging volume

# RF Interference / Zippers

#### Identification:

• Typically appears as single or multiple lines ("zipper") in the phase encoding direction

#### • Causes:

 Unexpected radiofrequency signal from equipment inside room, or outside room with poor RF shielding









# RF Interference / Zippers

#### • How to fix:

- Identify source, replace electronic components generating unwanted RF signal
- Check integrity of RF shielding, clean RF door threshold and RF fingers / plates

# Metal

- Identification:
  - Signal void, often with adjacent very bright signal
  - Geometric distortion

#### • Causes:

 Magnetic susceptibility, induced eddy currents, spin dephasing





















## Metal

- How to fix / reduce:
  - Properly screen patient, remove any metal that can be removed
  - Turbo spin echo and spin echo sequences reduce artifact compared to gradient echo
  - Decrease TE and echo spacing; increase bandwidth and resolution in frequency encoding direction
  - Swap phase and frequency to modify shape

## Corduroy

- Identification:
  - Pattern of regularly spaced lines extending across image
  - Can occur at different spatial frequencies and different angles
  - Multiple sets can combine to appear as a crosshatch pattern
- Causes:
  - Spike(s) in k-space







## Corduroy

• How to fix:

- Confirm room humidity in specification
- Perform scanner spike check
- Attempt to localize source if in room

# Suggested Reading

- DW McRobbie, EA Moore, MJ Graves, MR Prince, "MRI: From Picture to Proton," 2<sup>nd</sup> edition, Cambridge University Press
- Dietrich, "Artifacts in 3-Tesla MRI: Physical background and reduction strategies" EJR 2008 65(1) 29-35

