Received from the Matrix Quality Collaboration Committee July 2025-

Beam Hardening Artifact Reduction

- Beam hardening artifact is a type of artifact associated with CT.
- The artifact is created when a polychromatic X-ray beam passes through radiodense structures resulting in preferential absorption of lower energy photons.
- Radiodense structures include bone in adjacent limbs, iodine in vessels, and metallic material external to the patient.
- The remaining high-energy photons result in higher energy of the remaining X-ray beam.
- This creates the appearance of cupping and streaking. Importantly, this artifact can be reduced with proper attention to patient positioning.

Artifact may-

- Mask real lesions.
- Create the appearance of lesions that are not real.

Attention to artifact reduction is critical in-

- Improving diagnostic accuracy thereby improving patient care.
- Obviating the need for additional scans and associated radiation exposure.
- Reducing the risks of false positive results and unnecessary hospital stay and work-up/treatments.
- Reducing overall healthcare costs.

Reducing Artifact

- Use reconstruction algorithms, e.g. iterative reconstruction.
- Adjust energy settings.
- Automated artifact reduction protocols.
- Avoid high-density objects in scanning area, to include positioning arms outside the scanning area.

Example 1: Kidneys

Scan technique: Arms by side

Beam hardening artifact through kidneys

Difficult to rule out pyelonephritis or infarct

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Example 2: Kidneys

Scan technique: Arms by side

Beam hardening artifact through kidneys

Difficult to rule out pyelonephritis or infarct

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Example 3: Trauma

Scan technique: Arms by side

Beam hardening artifact through liver and spleen

Difficult to rule out hematoma/laceration

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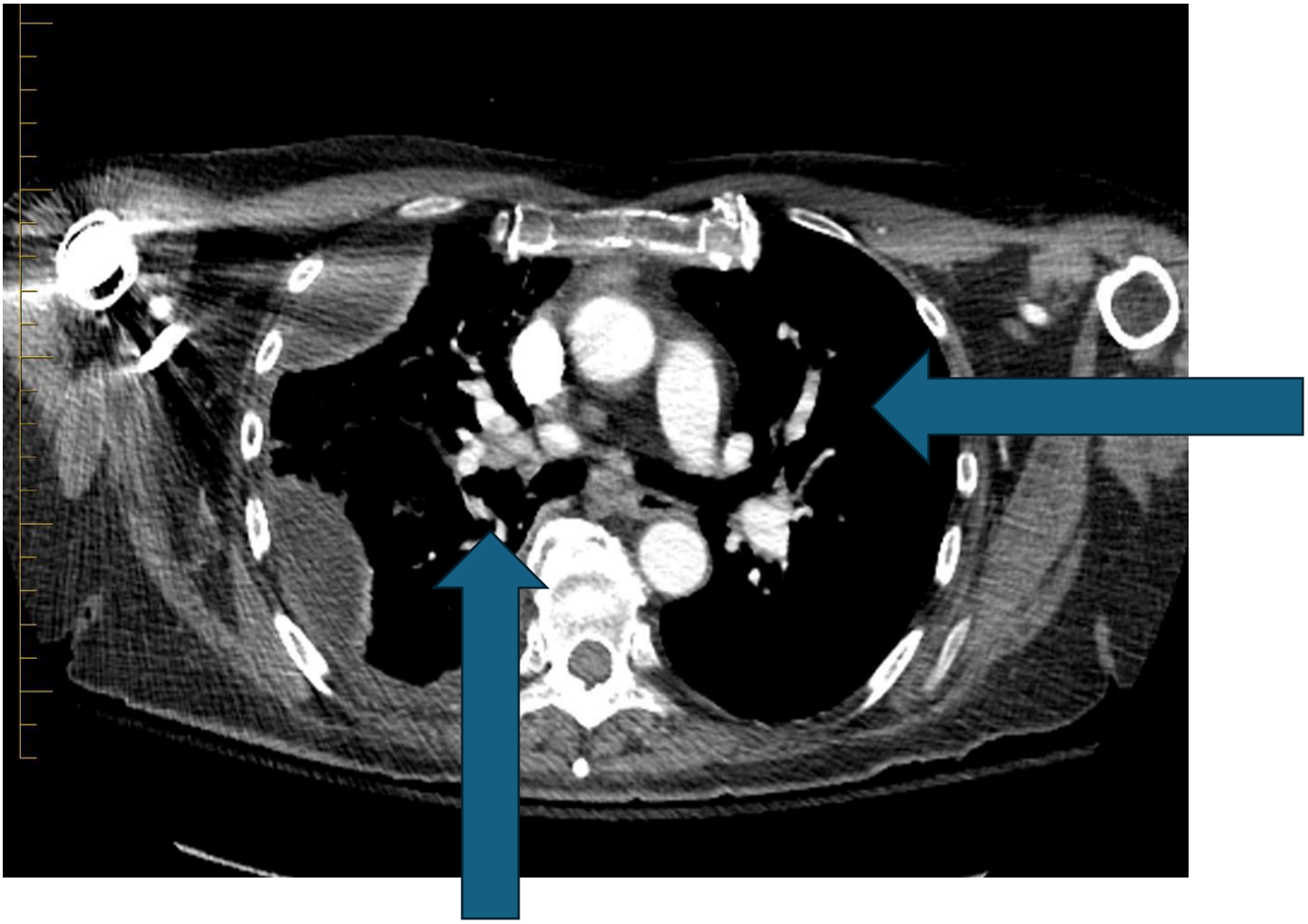
Example 4: Pulmonary Embolism

Scan technique: Arms by side

Beam hardening artifact through vessels

Difficult to determine whether filling defects are real or artifactual



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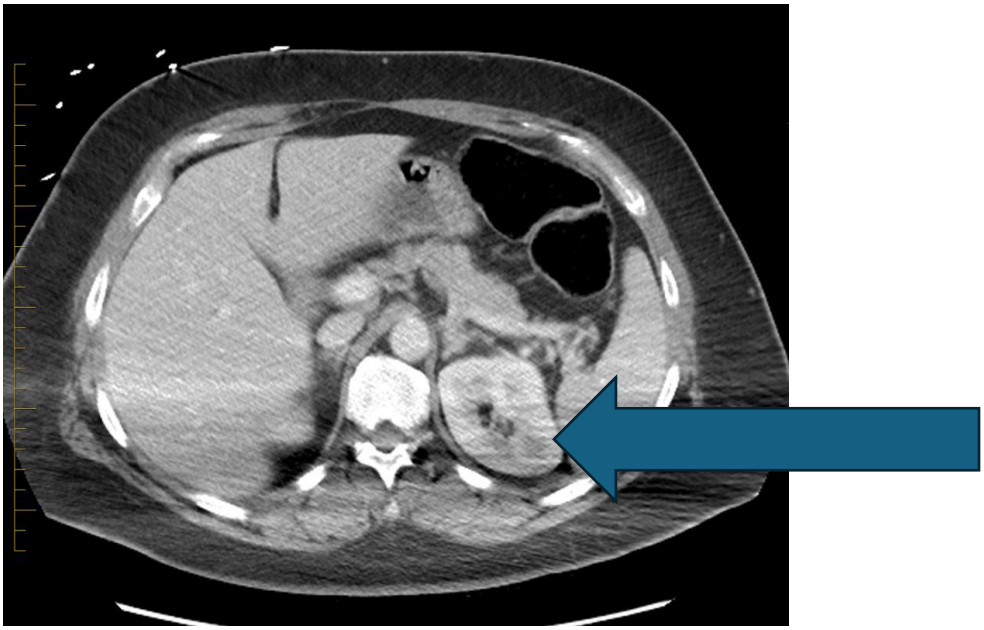
Example 5: Trauma… Renal pseudo-lesion?

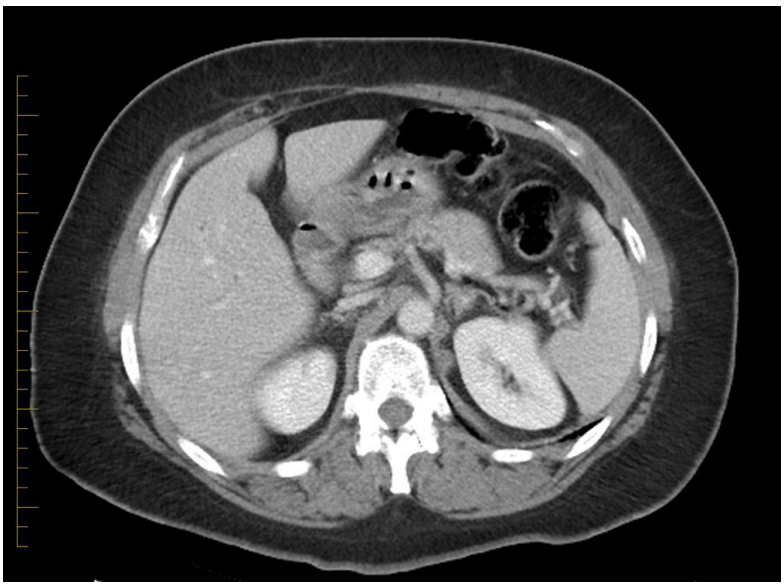
Scan technique: Arms by side

Beam hardening artifact through left kidney

Lesion in left kidney?



3 days earlier – proper positioning, normal appearance of left kidney



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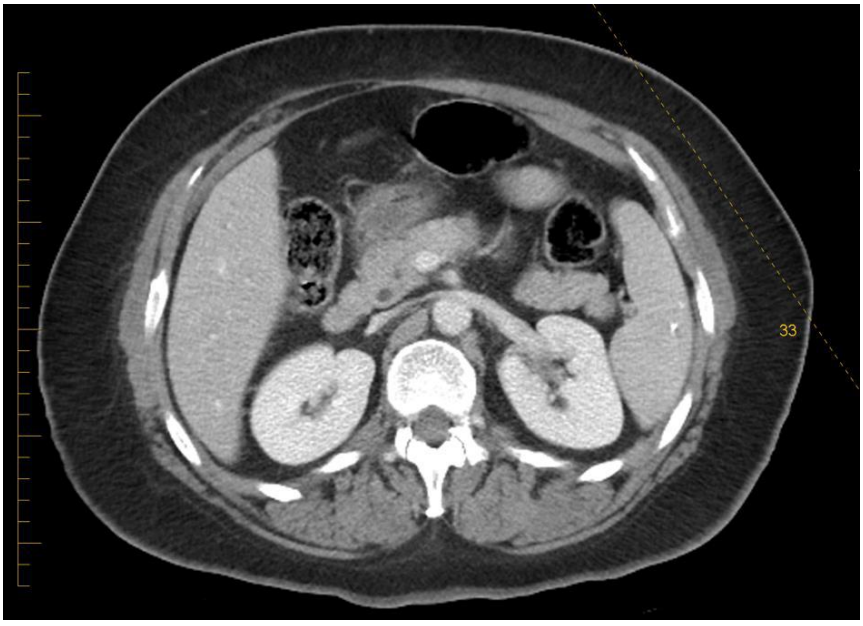
Example 6: Trauma… Renal-Hepatic-Splenic Pseudo-lesions?

Scan technique: Arms by side

Beam hardening artifact through liver, kidneys, spleen

Lesions in liver, kidneys, spleen?

Same patient 3 days earlier – proper positioning, normal appearance

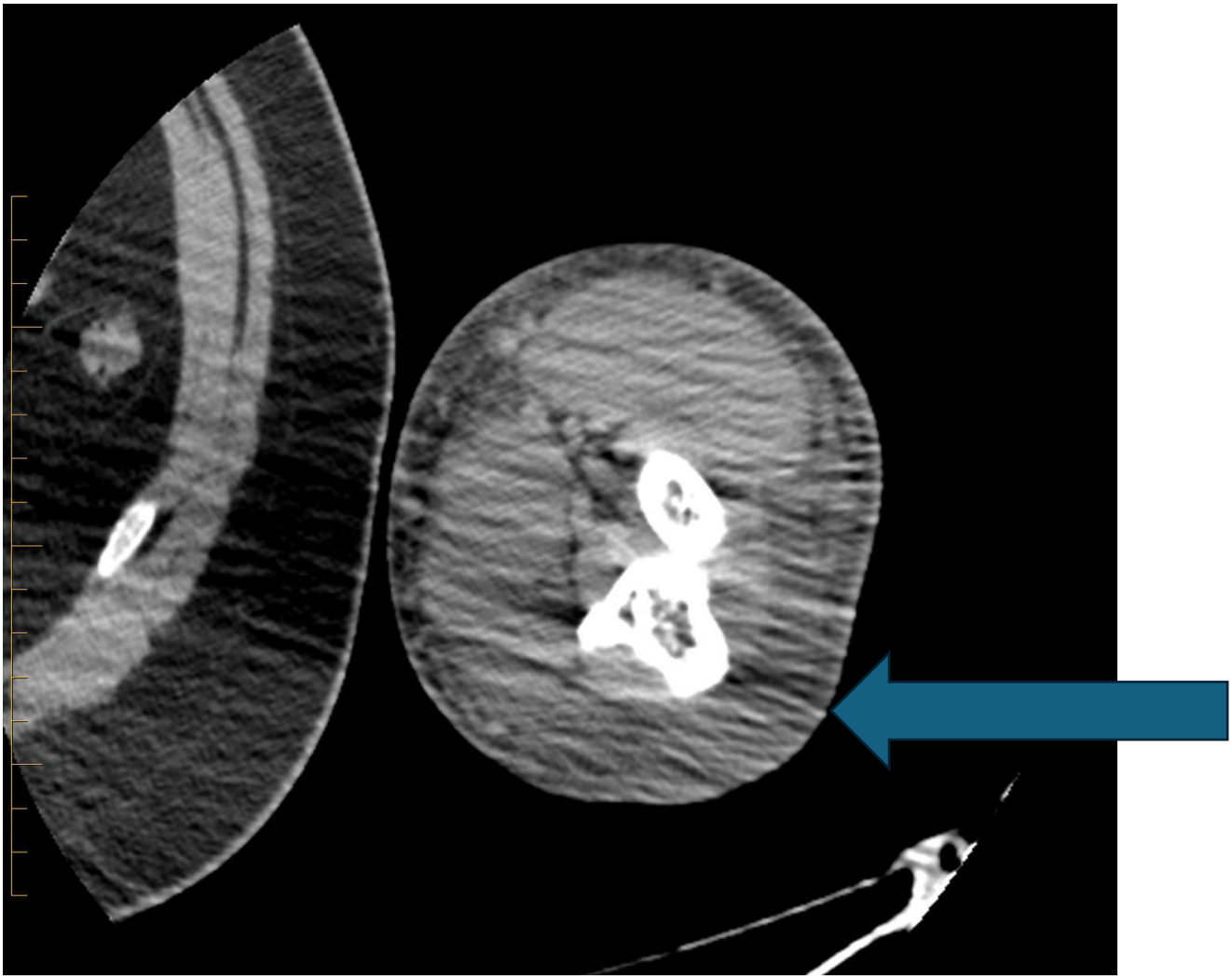


Example: 7: Concern for cellulitis/abscess

Scan technique: Arms by side

Beam hardening through arm

Difficult to determine if real cellulitis and/or abscess or artifact



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