

James M. Koffler, Ph.D.
Mayo Clinic Rochester

**IDENTIFYING IMAGE
ARTIFACTS, THEIR CAUSES,
AND HOW TO FIX THEM:
COMPUTED TOMOGRAPHY**

AAPM Annual Meeting 2017

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Case 1

“Ring” Artifact?

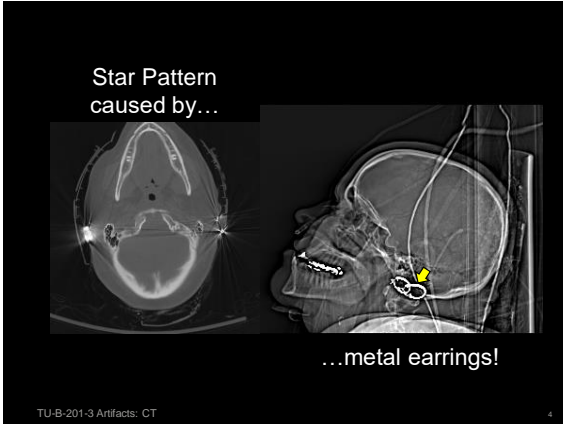
TU-B-201-3 Artifacts: CT

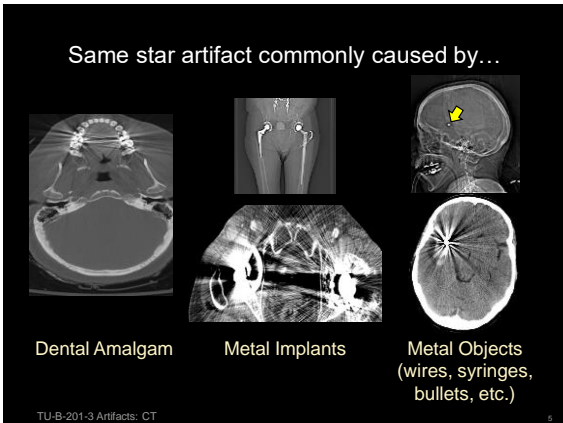
2



TU-B-201-3 Artifacts: CT

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Case 1

- Description
 - Star pattern
 - Obvious, and interferes with diagnostic content
 - Typically easy to determine cause
- Cause
 - Metal (high atten.) in FOV
- Remedy
 - Tilt gantry, avoid if possible
 - Increase kV, mAs (diminishing returns)
 - Metal Artifact Reduction algorithms

WE-G-209-2 Artifacts: CT, TU-B-201-3 Artifacts: CT 6

Case 1: Important Points

- Look at the localizer radiograph

WE-G-209-2 Artifacts: CT

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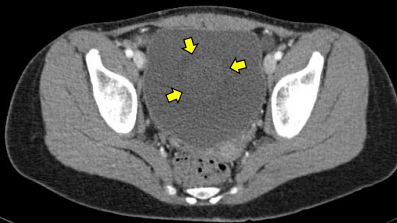
Case 2

- Description
 - One or more concentric rings in image
 - Subtle to obvious
 - Cause typically straightforward

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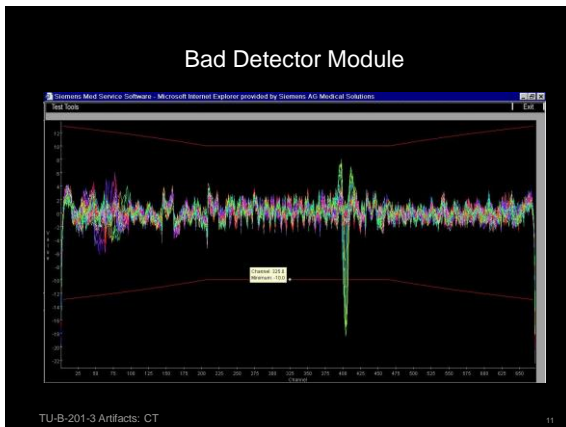
Ring Artifact

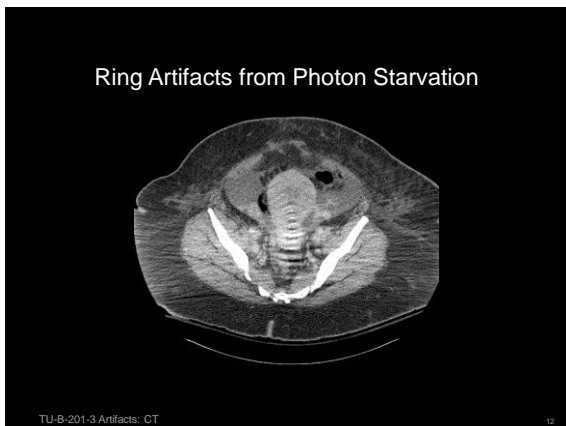


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Case 2

- Description
 - One or more concentric rings in image
 - Subtle to obvious
 - Cause typically straightforward
- Cause
 - Detector(s) imbalance/malfunction or blocked
 - Photon starvation
- Remedy
 - Service
 - Increase technique, if possible

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Case 2: Important Points

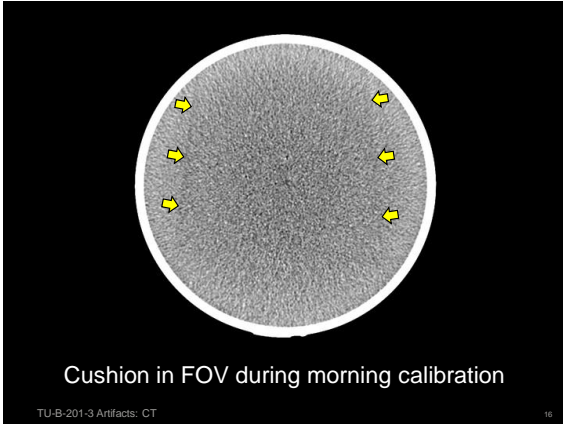
- Ring artifacts common
- Usually requires Service
- Scrolling can help visualize
- Check centering
 - Patient not always centered but rings are

TU-B-201-3 Artifacts: CT 14

Case 3

- Description
 - Some shape superimposed on images
 - Can be subtle but usually obvious
 - Usually doesn't mimic pathology
 - Not intermittent

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Case 3

- Description
 - Some shape superimposed on images
 - Can be subtle but usually obvious
 - Usually doesn't mimic pathology
 - Not intermittent
- Cause
 - Object scanned during calibrations
- Remedy
 - Re-calibrate

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Case 3: Important Points

- Don't overlook the simple things
 - "Object" could be cushion, pillow, phantom, etc.

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Case 4

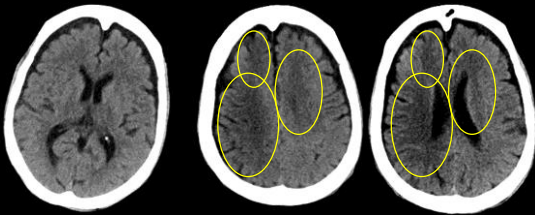
- Description
 - Dark “blotches” on head scan
 - Not too subtle but mimic critical pathology
 - Not intermittent

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Normal
(prior from
previous day)

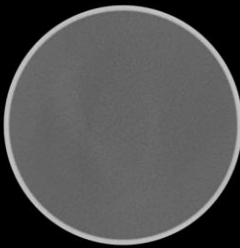
“Diffuse right
hemispheric abnormalities”
-Very serious



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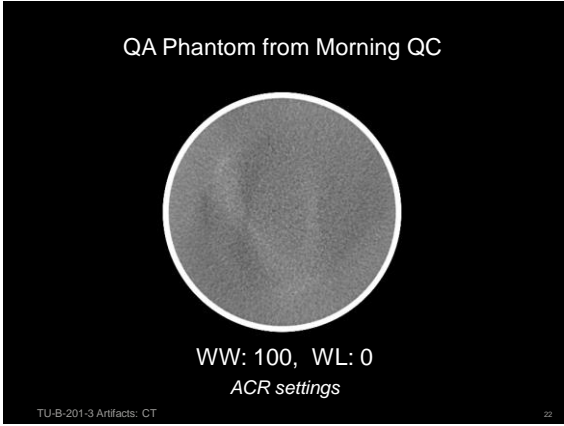
QA Phantom from Morning QC

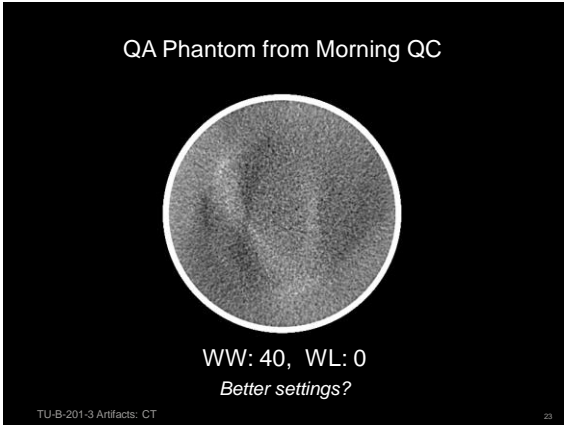


WW: 400, WL: 0
Typical abd settings

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Case 4

- Description
 - Dark "blotches" on head scan
 - Not too subtle but mimic critical pathology
 - Not random
- Cause
 - Contrast material on gantry window
- Remedy
 - Wipe off gantry
 - Note: Make sure not calibrated into system

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Case 4: Important Points

- Morning QAs must be reviewed carefully using appropriate ww/wl
- Suspected artifacts must be reported
- Inspect gantry between every patient for contrast spillage, if needed. Clean with water and tissue/cloth (no soap/disinfectants)
- Known spills should be cleaned immediately

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Case 5

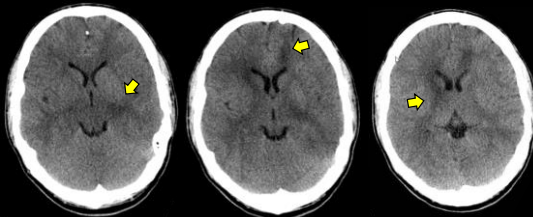
- Description
 - Irregular dark bands
 - Very subtle (2-3 HU) and mimics pathology
 - Intermittent, very infrequent

This is the most challenging, and most dangerous, type of artifact

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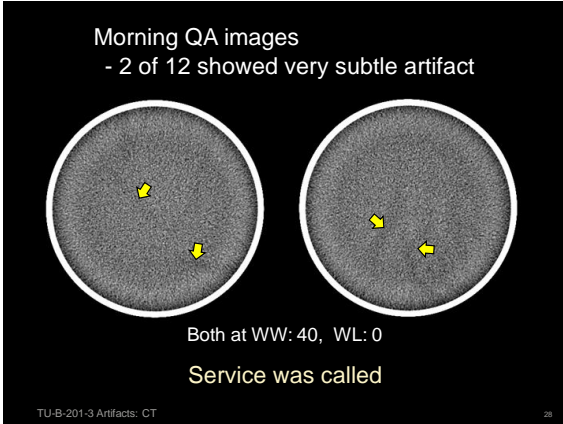
Suspected cerebral edema
-Very serious
-Patient transferred by ambulance
45 miles from remote site

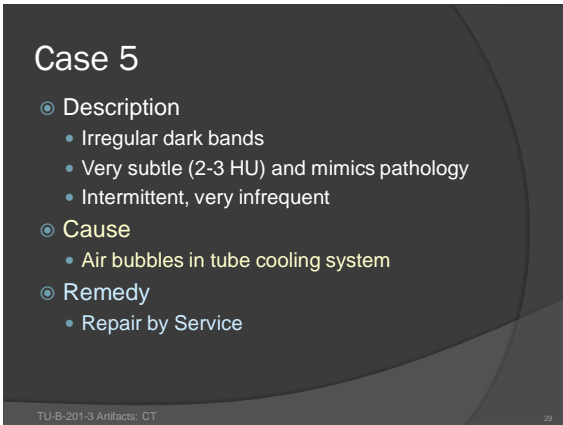


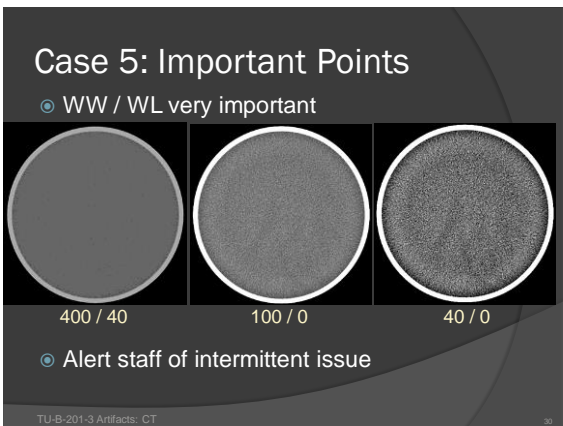
Happened with 2 different patients within 24 hours

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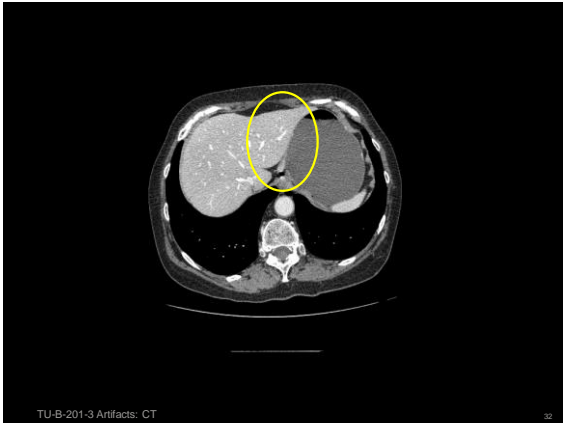
Case 6 (last one!)

● Description

- Partial "rings" not centered over isocenter
- Very obvious, does not mimic pathology
- Intermittent, very infrequent

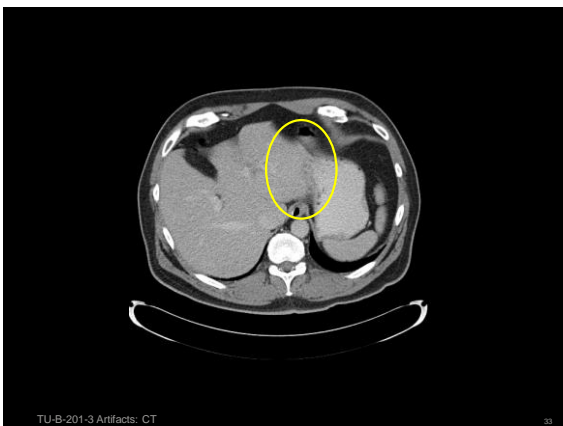
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Case 6 (last one!)

- ⦿ Description
 - Partial “rings” not centered over isocenter
 - Very obvious, does not mimic pathology
 - Intermittent, very infrequent
- ⦿ Cause
 - Moving air bubbles in patient
- ⦿ Remedy
 - No remedy—just identify
 - See it once and recognize forever!

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Clinical Image Artifacts

- ⦿ Be familiar with common artifacts
 - How to recognize
 - How to address
- ⦿ Trouble shooting
 - Start with the simple sources
- ⦿ Communicate concerns
 - Call Service when necessary
 - Provide sample cases, if possible
 - Let staff know of any potential problems
- ⦿ Technologists should be diligent

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References:

- Hsieh J., *Computed Tomography: Principles, Design, Artifacts, and Recent Advances* (Chapter 7), SPIE Press, Bellingham, WA, ISBN 0-8194-4425-1.
- Computed Tomography Quality Control Manual, 2012, American College of Radiology. <http://www.acr.org/Education/Education-Catalog/Products/8336734>
- Barrett JF, Keat N, Artifacts in CT: Recognition and Avoidance, *Radiographics* 2004; 24:1679-1691.
- Hedrick WR, Markovic MA, Short JA, Vera CD, Computed Tomography Artifact Created by Air in the X-ray Tube Oil, *JCAT*, 40(1) 2016.
- Liu F, Cuevas C, Moss AA, Kolokythas O, Dubinsky TJ, Kinahan PE, Gas Bubble Motion Artifact in MDCT, *AJR*: 190, Feb 2008.

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