IDENTIFYING IMAGE ARTIFACTS, THEIR CAUSES, AND HOW TO FIX THEM: COMPUTED TOMOGRAPHY
Case 1

“Ring” Artifact?
(Frame from animation in presentation)
Star Pattern caused by...

...metal earrings!
Same star artifact commonly caused by...

- Dental Amalgam
- Metal Implants
- Metal Objects (wires, syringes, bullets, etc.)
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
Case 1: Important Points

- Look at the localizer radiograph
Case 2

Description

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

Service was called

(Frame from animation in presentation)
Bad Detector Module

Channel: 325.0
Minimum: -10.0
Ring Artifacts from Photon Starvation
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
Case 2: Important Points

- Ring artifacts common
- Usually requires Service
- Scrolling can help visualize
- Check centering
  - Patient not always centered but rings are
Case 3

- **Description**
  - Some shape superimposed on images
  - Can be subtle but usually obvious
    - Usually doesn’t mimic pathology
  - Not intermittent
Cushion in FOV during morning calibration
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
Case 3: Important Points

- Don’t overlook the simple things
  - “Object” could be cushion, pillow, phantom, etc.
Case 4

- **Description**
  - Dark “blotches” on head scan
  - Not too subtle but mimic critical pathology
  - Not intermittent
Normal (prior from previous day)

“Diffuse right hemispheric abnormalities”
- Very serious
QA Phantom from Morning QC

WW: 400, WL: 0

Typical abd settings
QA Phantom from Morning QC

WW: 100, WL: 0

ACR settings
QA Phantom from Morning QC

WW: 40, WL: 0

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

Happened with 2 different patients within 24 hours
Morning QA images
- 2 of 12 showed very subtle artifact

Both at WW: 40, WL: 0

Service was called
Case 5

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

- **Cause**
  - Air bubbles in tube cooling system

- **Remedy**
  - Repair by Service
Case 5: Important Points

- WW / WL very important

- Alert staff of intermittent issue
Case 6 (last one!)

- Description
  - Partial “rings” not centered over isocenter
  - Very obvious, does not mimic pathology
  - Intermittent, very infrequent
(Frame from animation in presentation)
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!
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
References:


- Hedrick WR, Markovic MA, Short JA, Vera CD, Computed Tomography Artifact Created by Air in the X-ray Tube Oil, JCAT, 40(1) 2016.

Artifact from Tube Arcing

(Frame from animation in presentation)