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

Case 1

“Ring” Artifact?
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
8/1/2017

Ring Artifact
Service was called

Bad Detector Module

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
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
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
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