ARTIFACTS IN DIGITAL BREAST TOMOSYNTHESIS AND SYNTHESIZED 2D IMAGING

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INTRODUCTION COMMON ARTIFACTS IN DBT AND S2D

• Basic Tomosynthesis Imaging
• Synthesized 2D Imaging
• Common Artifacts
  • Out of Plane artifacts (Zipper, Slinky)
  • Metallic or Halo Artifact
  • Skh Line Processing Error
  • Terracing artifact
  • Bright or Dark Pixel Artifact
  • Motion Artifact
  • Disappearing or Unexpected Appearance of Calcifications
• Mitigation of Artifacts

VERY BASIC DBT PHYSICS

• Several projection images obtained
  • GE – 8 images in 25 degree sweep
  • Hologic – 15 images in 15 degree sweep
  • Siemens – 25 images in 50 degree sweep
• Processing algorithm used to reconstruct tomosynthesis slices
  • Filtered Back Projection (Hologic, Siemens, Fuji)
  • Iterative Reconstruction (General Electric, Siemens)
SYNTHESIZED 2D IMAGING

- Maximum intensity projection of the 3D image data set
- Some features are enhanced – lesion-like features, calcifications
- Synthesized Mammographic 2D Imaging – Theory and Clinical Performance

OUT OF PLANE ARTIFACTS - CALCIFICATIONS

Slice 10

Slice 10 of 75
Zoomed

Slice 43 of 75

OUT OF PLANE ARTIFACTS - CALCIFICATIONS
OUT OF PLANE ARTIFACT – METALLIC OBJECT – S2D

Reprocessing to Minimize Metallic Object Artifact

MITIGATION OF METALLIC OBJECT ARTIFACT

- Tested several methods
  - Projection segmentation
  - Maximum contribution detection
  - Iterative classification
  - Maximum contribution detection worked best
SKIN LINE PROCESSING ERROR

SKIN LINE FADING CAUSE

- High kVp used for projection imaging
- Detector saturated in area of skin leading to processing errors

TERRACING ARTIFACT
MITIGATION OF THE TERRACING ARTIFACT

- No known way to mitigate this artifact.
BLACK HOLE 2D VS. S2D

DEAD PIXEL (WHITE PIXEL)

ELIMINATION OF THESE ARTIFACTS

- The dark pixel artifact was eliminated with a new gain and offset calibration
- White pixel artifact was found to be a dead detector element
- The detector element was "mapped out" by the service engineer using a software tool provided by Hologic
DISAPPEARING CALCIFICATIONS

Causes:
- Binning of detector elements during readout
- Calcifications not all in same plane in tomosynthesis image stack

Remediation:
- Using native resolution of detector
- Increasing slab thickness when scanning through tomosynthesis images

DISAPPEARANCE OF CALCIFICATIONS

DISAPPEARING CALCIFICATIONS
UNEXPECTED APPEARANCE OF CALCIFICATIONS

• Processing algorithm for s2d images enhances existing calcifications
• Areas that may appear as tissue on a 2D image may be enhanced to look like calcifications
• Appearance of calcifications may cause call back for magnification views

PSUDEOCALCIFICATIONS CAUSE

SUBCUTANEOUS TISSUE BLURRING - BRIGHT BAND - CC
BRIGHT BAND - MLO

Secondary to acquiring tomosynthesis sections
Due to curvature of the breast tissue at the edges of the breast
Less information at edges for the processing algorithm to work with
Processing algorithm produces bright band in areas of lower information

QUESTIONS?