Visualizing the Real Difference between 2-D and 3-D Specimen Mammography

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Abstract:

BACKGROUND: Specimen mammography aids in the determination 1) if the target lesion has been removed and 2) whether there is a clear margin at excision. In the past, two orthogonal views using 2-D imaging has been considered to be equivalent to a three dimensional perspective. Yet tomosynthesis for screening mammography has demonstrated the value of thin sliced imaging over two view screening mammography. In March, 2015, we began using true 3-D tomosynthesis of breast specimens at lumpectomy and have compared 2-D and 3-D specimen mammography.

-METHODS: We have examined 125 consecutive breast cancer patients with both 2-D and 3-D imaging of the same specimens since March 2015. The circulating nurse would take the specimen and obtain two orthogonal views using both 2-D and 3-D devices with images sent to the radiology department. It was not felt ethical to blind the surgeon from having both images available to make an intraoperative clinical decision regarding immediate re-excision. We compared the data noted from each method and which method best aided the decision to perform immediate re-excision, and time required to obtain the images.

-RESULTS: We have studied 125 patients over 11 months since March 2015. Confirmation of complete lesion excision was easier with 3-D tomosynthesis than with 2-D as the 3-D slice did not include overlying skin or dense breast tissue surrounding the lesion in the image, making the target lesion stand out more clearly. Although the 2-D images appear to have higher contrast than the individual 3-D slices, the tomosynthesis 3-D images contained more actionable data than the 2-D. Also decisions to excise more tissue during the procedure were enabled by the additional information included in the 3-D images. In addition, the 3-D images provided the depth of field to enable accurate re-excision using the Z-axis (see figures). Finally, it took about a minute longer to obtain and review the 3D images, although this difference did not delay surgical decisions nor prolong operative time.

-CONCLUSIONS: 3-D specimen tomosynthesis facilitates the reduction of post-operative re-excision for lumpectomy patients by providing more information than 2-D orthogonal views, providing easier, more accurate confirmation of the extent of the target excision. Additionally, serial 1mm slices of the specimen allowed the integration of Z-axis targeting, ensuring that any necessary margin excision during surgery was accomplished immediately with maximum tissue conservation. More studies are planned to further validate these findings of these first 125 patients.

Summary

- Facilitates lower re-excisions by visualizing more information
- Accurately identifies target lesion with greater detail
- Excludes overlying skin and surrounding dense breast tissue
- Rolled tomo images provide spatial orientation of margins
- Ease of use identical to 2D systems, uploads easily to PACS
- Time from image capture to 3-D ~ 100 seconds
- Margins identified in three axes for intraoperative excision
- Provides anatomic orientation of close margins using Z-axis
- Confirms removal of vague mammographic findings

Two 2-D orthogonal views may not show positive margin

3-D slices demonstrate positive margin and depth in mm