

Advanced Observation in Breast Examinations 3D Ultrasound



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Introduction

Continuous technical innovations and growing experience in 2D imaging of breast lesions have resulted in increased reliability of diagnostic ultrasound in the evaluation of breast lesions.

Early detection and screening for cancer are two areas constantly being explored by researchers. Maximum importance is given to characterizing the margins of breast lesions when it comes to diagnosis of malignancy.

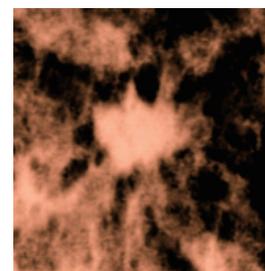
This is exactly what 3D ultrasound promises to offer. Analyzing volumetric data and gaining additional information on the tumor margins in three orthogonal planes form the basis of 3D application. Important information of surrounding tissues is a great benefit. Limitations do exist, as is evident from papers showing varied results.

Materials and Methods

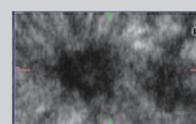
I used the system ProSound Alpha 7 of Hitachi Aloka Medical with three probes. Two linear probes, UST-5411 and UST-5412 with frequency ranges of 4 to 13 MHz were used for 2D imaging. ASU -1013 with a frequency range of 4 to 13 MHz was used for 3D.

2D imaging was performed using Broadband Harmonics (BbH), Adaptive Image Processing (AIP), Spatial Compound Imaging (SCI) and Sound Velocity Adjustment. I have also incorporated Volume Slice Imaging (VSI), a new technology introduced by Hitachi Aloka Medical in order to establish its utility. A short note about VSI imaging is given below.

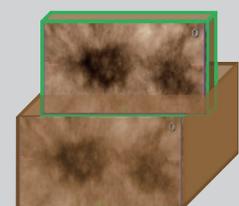
Volume Slice Imaging is a function that works on acquired volume data. The volume can be viewed from any direction. VSI can deliver clear thin 3D images with high contrast resolution, due to reduction of speckle noise by effect of spatial correlation. Slice thickness can be changed according to lesion and organ of study, to obtain better contrast and best 3D demonstration. In breast applications I have tried to estimate the efficacy of VSI using GVR (Gradient Volume Rendering) and Inversion mode (inversion of 2D brightness).



Volume Slice Imaging (VSI)



C-plane



C-plane (VSI Display)

VSI can deliver clear thin 3D images with high contrast resolution.

BREAST CARCINOMA

Breast cancer rate has been on the rise at a young age, and more and more women are becoming aware of the disease. Combination of this social background, current high resolution status of the equipment and better expertise of the sonographers has helped the clinicians tremendously in achieving the diagnosis.

Ultrasound features that lead to the diagnosis of malignancy are heterogenous and hypoechoic nature, irregular borders, microlobulations, spiculations, microcalcifications, larger height than width, and architectural distortion.

■ Case

70 year old woman, presented with edema of right upper limb. B-mode imaging shows multi-centric lesions in the right breast with sonography features of spiculations, lobulations and an echogenic halo, which

are consistent with malignancy. 3D ultrasound imaging of the right breast offers better definition of these features.



Fig. 3.A. B-mode image using broadband high frequency probe shows spiculated margins of the lesion in right breast at 11 o'clock position.

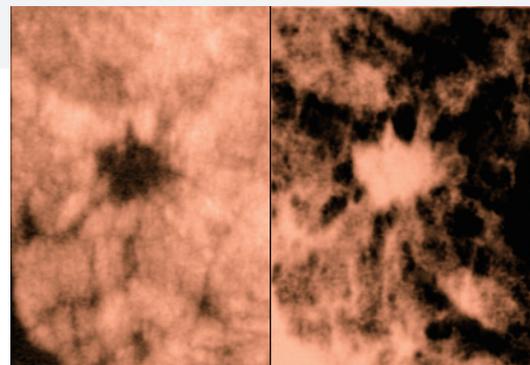


Fig. 3.B. VSI images in coronal plane (top view). X-ray rendered image at 1 mm thickness (left) and inversion mode image at 8 mm (right) clearly depicts the spiculated margins.

INVASIVE DUCTAL CARCINOMA

■ Case

40 year old woman presented with a lump in the left breast, hard on palpation. B-mode imaging reveals irregularity of the anterior wall with suspicious fine

spiculations suggestive of malignancy. Angular margins, spiculations and irregular borders are well demarcated on the VSI image.



Fig. 4.A. Left breast 11 o'clock hypoechoic solid mass, with irregular indistinct margins of the anterior surface.

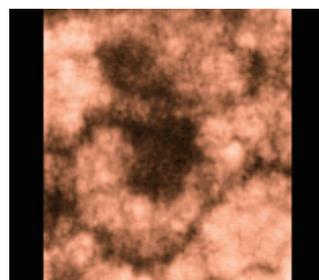


Fig. 4.B. VSI 1 mm thickness offers additional features in favor of malignancy. Lobulations, spiculations, and angular margins are conspicuous. Ultrasound features strongly suggest malignancy. Histopathological findings – invasive duct carcinoma.

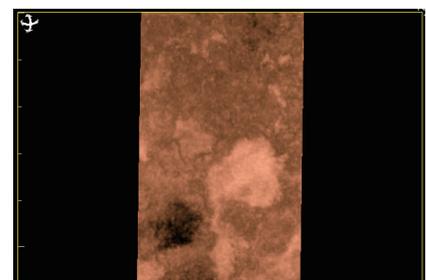


Fig. 4.C. VSI Inversion mode of 12 mm thickness. Irregularity of the margins are best evident.

SUMMARY

My short initial experience with this Hitachi Aloka Medical 4D linear probe has been interesting. I feel this technology provides more comprehensive information which can be of great help to the oncologists in planning their treatment. Coronal views play a key role in this aspect. Tumor wall characterization and the surrounding tissue infiltration appear more precise. 3D imaging can play a major role when there are multiple lesions. With more experience and further refinements in the technology I am confident this will offer lot of promise.

VSI with thin slices is one such exciting area as is evident in this study. At this stage the role of 3D is complimentary to other breast imaging techniques and best results will be obtained when used in conjunction with these imaging modalities. I feel VSI imaging has a bright future in the assessment of ductal pathologies.

Features of the Breast 3D Probe

- Offers clear images in both 2D (B-mode) and 3D.
- Has excellent resolution as well as high sensitivity that reaches to as far as the greater pectoral muscles.
- The Check-scan function scans the maximum scanning range to display 2D images before obtaining 3D data to verify that the entire target necessary for 3D imaging is within the range.



Useful in observations of :

- Tumors and the relations with its surrounding tissues
- Border between the two, contraction, invasion, spicula

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