GE Healthcare

Advantages of Volume Ultrasound for the evaluation of breast lesions

Monali Padwal, M.D., RDMS
Clinical Specialist, Ultrasound
GE Healthcare

Introduction

Breast cancer is the most common, life-threatening cancer.[5] Today, ultrasound plays an increasingly important role in the evaluation of breast lesions. Ultrasound exams are relatively inexpensive and do not use X-rays or other types of potentially harmful radiation. Ultrasound can differentiate between solid and cystic breast masses, help to define the nature and extent of a mass, and show all areas of the breast, including the area closest to the chest wall, which can be difficult to study with a mammogram. Breast examination using ultrasound has become a major adjunct to mammography.

Two-dimensional (2D) ultrasound is a gray-scale display of the area being imaged. The user is required to mentally integrate the 2D images to form a three-dimensional (3D) impression of the anatomy under investigation.[4] Volume Ultrasound, on the other hand, allows multiple planes to be reconstructed from a single data acquisition, with unlimited access to multiple viewing angles.[1,3,4] Two-dimensional data is processed with various software algorithms and then can be displayed as a surface rendered image or as a multi-planar image display.

In the cases presented, the LOGIQ® 9 ultrasound scanner was used to generate static 3D renderings of the breast with a high-frequency 4D16L volume transducer (GE Healthcare, Milwaukee, WI). The volume transducer acquires multiple 2D frames at pre-determined intervals, each frame being tagged with a unique identifier and time stamp that can place its spatial and temporal location in a volume. These frames are then assembled in a continuous memory block and passed to the volume rendering engine, which converts the raw data into a set of parallel 2D slices using interpolation and gray maps. The slices are then converted into a volume rendering.

The main advantage of Volume Ultrasound is the ability to display a questionable area in the coronal plane, an imaging plane parallel to the skin, which cannot be visualized using conventional 2D ultrasound.[1,4] Coronal plane imaging allows for better delineation of the contours, margins, and overall topography of a breast lesion.[1] The spiculated margins of a malignant breast mass and associated retraction phenomena are very well visualized in the coronal plane, as is the distortion of the surrounding soft tissue; which is considered to be an important sign indicative of malignancy. Volume Ultrasound also provides a better understanding and visualization of the complex branching patterns of ducts within the breast and can help facilitate localization of a needle during biopsy.[1] The following cases demonstrate some advantages of Volume Ultrasound over traditional 2D ultrasound for evaluating breast lesions.

Case 1

A 35-year-old woman presented with unilateral breast pain. The 2D image (Fig. 1) reveals a hypoechoic area with convex outer margins, which could be interpreted as a mass. The 3D multi planar image (Fig. 2) revealed the same area in three orthogonal planes. The contours and topography are displayed very well in the coronal plane (C) making it very suggestive of a normal fat lobule.

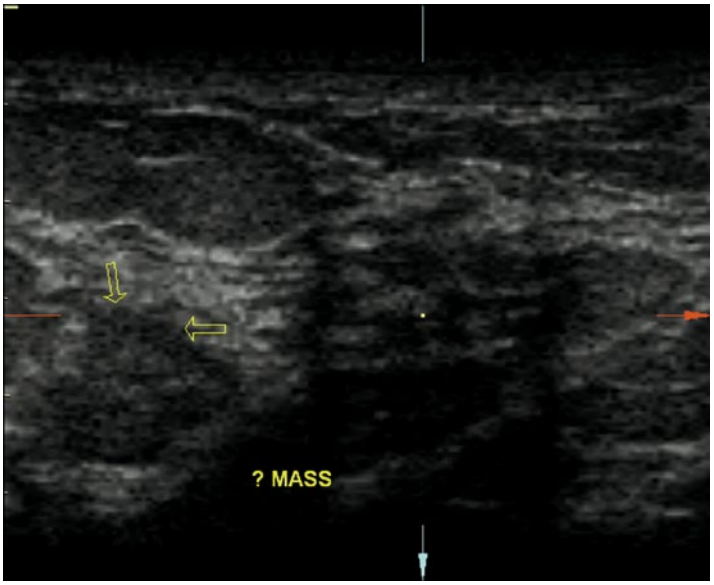

Figure 1
Conventional 2D ultrasound – sagittal view.

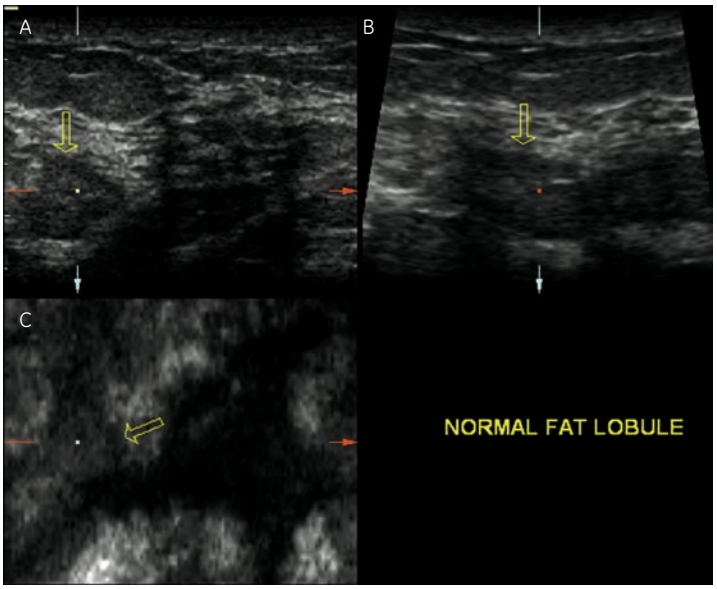

Figure 2
Volume Ultrasound multi planar image display.
A) Sagittal B) Transverse C) Coronal plane

Case 2

A 22-year-old woman presented with a palpable breast lump. Both 2D (Fig. 3) and 3D (Fig. 4) ultrasound revealed a region of asymmetrically dense fibrotic breast tissue corresponding to the area in question, which was also confirmed on mammography and breast MRI. The reconstructed coronal plane (C) revealed the overall extension of the area of dense breast tissue and its contours much better than conventional 2D ultrasound. Histopathology results corroborated the Volume Ultrasound findings of dense fibrotic breast tissue.

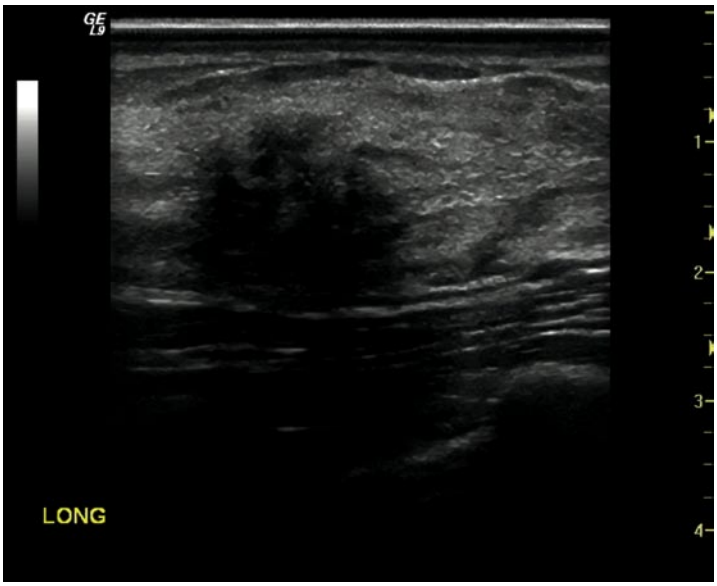

Figure 3
Conventional 2D ultrasound. Transverse view.

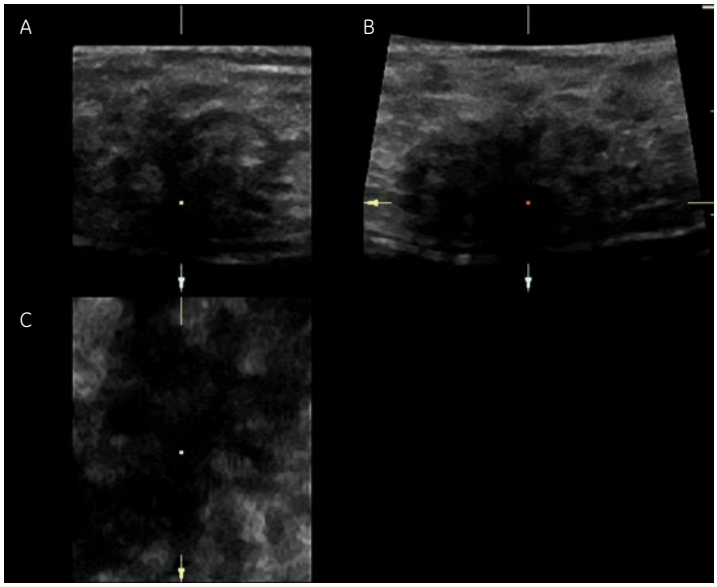

Figure 4
Volume Ultrasound multi planar image display.
A) Sagittal B) Transverse C) Coronal

Case 3

A 45-year-old woman with a family history of breast cancer presented with a hard lump in the right breast. Both 2D and 3D ultrasound revealed a suspicious hypoechoic mass with posterior shadowing. The reconstructed coronal plane and adjacent rendered image (Fig. 5C and D) reveal the spiculated margins of the mass very well along with retraction and distortion of the surrounding tissues. This additional clinical information was not accessible in the standard scanning planes.

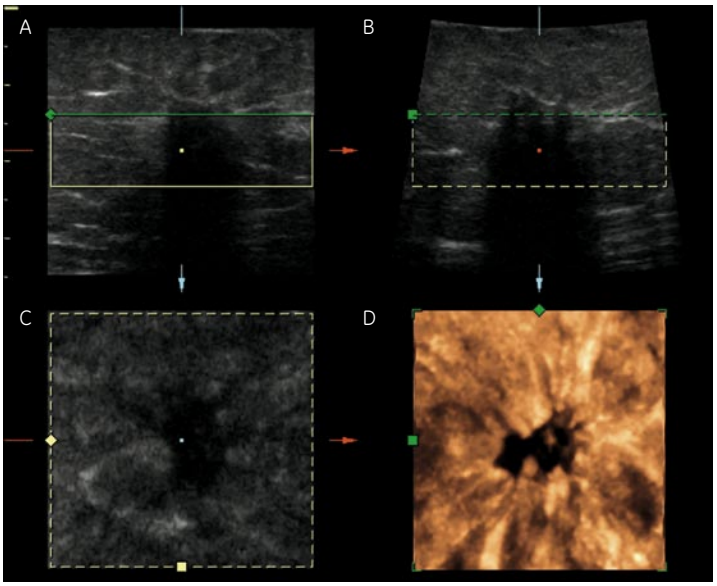

Figure 5
Volume Ultrasound multi planar image display.
A) Sagittal B) Transverse C) Coronal D) Rendered images

Discussion

Although the diagnostic accuracy of both 2D and Volume Ultrasound in breast imaging is comparable, the latter provides access to multiple viewing planes, mainly the coronal plane, allowing for better delineation of the overall topography, contours and margins of a breast lesion. With recent advances in computer technology, Volume Ultrasound using real time and static 3D modes promises to play an increasingly important role in modern medicine.[4]

References:

1. Watermann DO, Foldi M,Hanjalic-Beck A, Hasenburg A, Lughausen A, Prompeler H, Gitsch G, Stickeler E. Three-dimensional ultrasound for the assessment of breast lesions.Ultrasound Obstet Gynecol 2005; Jun; 25(6) : 592-8

2. Cho KR, Seo BK, Lee JY, Pisano ED, Je BK, Lee JY, Choi EJ, Chung KB, Whan OhY. A comparative study of 2D and 3D ultrasonography for evaluation of solid breast masses. Eur J Radiol. 2005 Jun; 54(3) : 365-70

3. Szebeni A, Rahoty P, Besznyak I. Clinical validity of new ultrasound methods in the differential diagnosis of breast diseases. Breast . 2002 Dec; 11(6) : 489-95

4. Downey DB, Fenster A, Williams JC. Clinical utility of three-dimensional US. Radiographics. 2000 Mar-Apr; 20(2) : 559-71

5. Hartmann LC, Loprinzi CL, Rochester (Kensington Publishing Corp NY 2005) Mayo Clinic Guide to Women's Cancers

For more than 100 years, scientists and industry leaders have relied on General Electric for technology, services and productivity solutions. So no matter what challenges your healthcare system faces – you can always count on GE to help deliver the highest quality services and support. For details, please contact your GE Healthcare representative today.

GE Healthcare
Waukesha, WI U.S.A
888 202 5528
www.gehealthcare.com

imagination at work

ULT-0233-10.05-EN-US