Time Intensity Curve Analysis of Malignant Enhancing Breast Lesions: atypical findings more frequent in smaller lesions

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Purpose: Dynamic contrast-enhanced (DCE) breast MRI has emerged as an important method for detection and evaluation of breast lesions and in screening studies it has been shown to be about twice as sensitive as mammography [1]. The signal intensity vs. time curve (TIC) is helpful in determining diagnosis, with delayed washout being the most suspicious finding. We have anecdotally noted that small lesions may not display washout with the same frequency as larger lesions. To our knowledge this has not been specifically studied in the past, though occasionally is noted as part of another study [2]. In this retrospective study we looked at TIC data as a function of lesion size to determine if radiologists should de-emphasize TIC when making a diagnosis of a small enhancing mass.

Patients and Methods: With IRB approval, we evaluated 81 malignant lesions in 68 patients (mean age of 49, 28-78) over a 3-year-period from 2005-08. All lesions were pathologically proven. All patients were referred for DCE MRI of the breast using Gd-DOTA (Omniscan®, GE Healthcare) to characterize uncertain mammographically detected lesions or to stage known breast cancers. MRI was performed using the standard protocol for clinical MRI at our institution (GE Echospeed 1.5 T or GE Twinspeed 1.5 T scanner [General Electric Health Care, Waukesha, WI]). The temporal resolution of DCE MRI was 60 - 75 s/acquisition, acquired at 8 time points. The lesion size and TIC's were measured using Dynacad (Invivo) or Functool (GE Healthcare) software and kinetic parameters were assigned: rapid/medium/slow rise and persistent/plateau/washout delayed. Out of the 81 breast cancers 67 were infiltrating ductal cancer, 13 were infiltrating lobular cancer and one ductal carcinoma in situ (DCIS).

Results: Lesion size distribution was as follows: 11 lesions under 1 cm, 39 between 1-2 cm and 31 over 2 cm. TIC data as a function of size was (fig 1) : **> 2 cm** - rapid rise /washout in 68% (21), rapid rise/plateau in 22% (7) and 10% (3) with medium rise/plateau. None showed persistent pattern. **1 – 2 cm** - 79,5% (31) showed rapid rise/washout, 15% (6) showed rapid rise /plateau and 5% (2) medium rise/plateau. None showed persistent pattern. **< 1 cm** - 54,5% (6) with rapid rise/washout, 9% (1) with rapid rise/plateau, 18% (2) medium rise/plateau and 18% (2) medium rise/persistent. Although, overall, no significant differences were found in the TIC assignments for the three size distributions, nevertheless, the medium/persistent assignment was only seen in sub-cm lesions.

Conclusion: The dependence of kinetic data on lesion size has been rarely studied. In a small retrospective study, our data showed that almost 20% of lesions less than 1 cm displayed persistent delayed enhancement, a property usually associated with benignancy, and not seen in larger malignant lesions. Radiologists interpreting breast MRI should be aware that TIC patterns may not be as reliable for small lesions (fig.2) and increased emphasis on lesion morphology and distribution may be required to make the diagnosis.

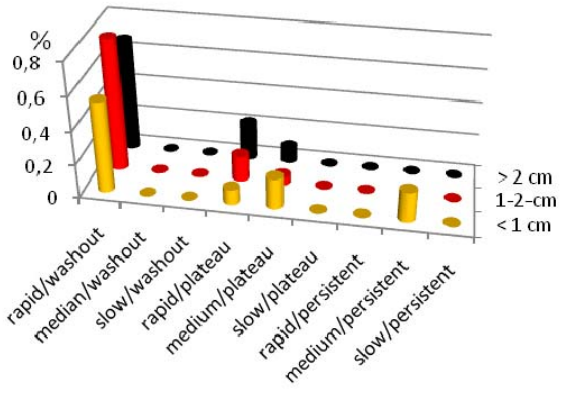

Fig.1. Distribution of kinetic data by lesion size

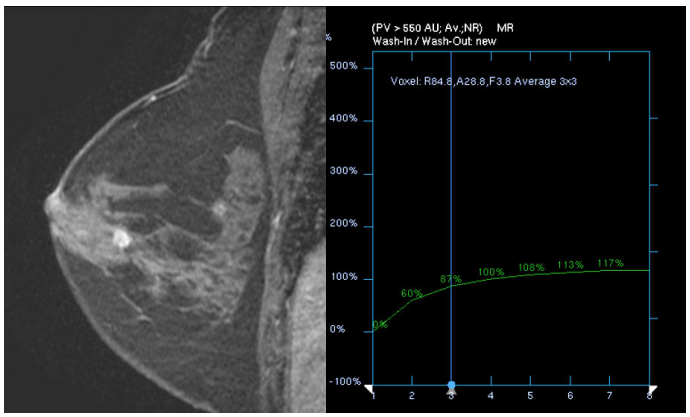

Fig.2. 58 yo woman with 9 mm invasive ductal cancer and persistent delayed enhancement

References:

1. Elmore, J.G., et al., *Screening for breast cancer.* JAMA, 2005. **293**(10): p. 1245-56.
2. Wang, L.C., et al., *MRI-detected suspicious breast lesions: predictive values of kinetic features measured by computer-aided evaluation.* AJR Am J Roentgenol, 2009. **193**(3): p. 826-31.