

Assessing the accuracy of a commercial computer aided diagnosis package (CADstream) in determining the level of disease post neoadjuvant chemotherapy in a cohort of breast cancer patients

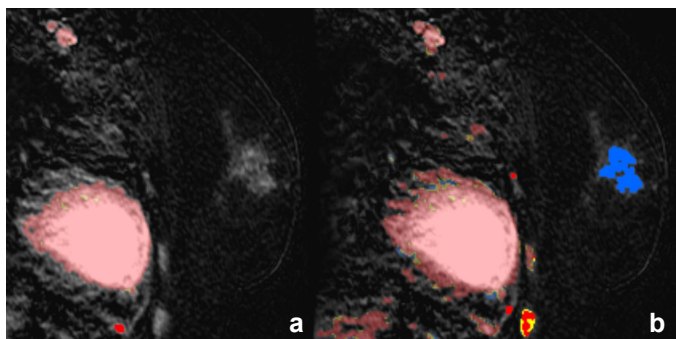
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Introduction CADstream is a commercially available computer aided diagnosis (CAD) package developed to aid in the interpretation of breast MR data. CADstream corrects for patient movement via an image registration algorithm and produces a parametric map (AngioMap) based on a user defined enhancement threshold and the shape of the time signal intensity curve. Reports have demonstrated that CADstream provides quicker interpretation^{1,2}, increased specificity³ and greater correlation with histological measurements of tumour size². However, these reports are based on the assessment of pre-treatment lesions and not post chemotherapy lesions where a treatment induced vascular shutdown is anticipated. The aim of this study was to determine the accuracy of CADstream in the assessment of breast lesions post neoadjuvant chemotherapy.

Methods Twenty biopsy proven breast cancers in 19 patients underwent breast MR prior to and post neoadjuvant chemotherapy. All patients were scanned on a 3.0T HDx scanner (GE Healthcare) utilising VIBRANT sagittal bilateral dynamics with a typical temporal resolution of ~30secs and a 0.91x1.36 x2mm spatial resolution. MR data was processed using CADstream (Confirma) and in all cases the longest diameter was recorded from the AngioMap.

To determine any effects a treatment induced vascular shutdown may have had on CADstream three different enhancement thresholds were used – 50% MED, 30% MED and 30% LOW. In our practice the 50% enhancement threshold is utilised in the pre-treatment setting, anticipating a vascular shutdown this was reduced to 30% for post chemotherapy patients. The MED and LOW settings refer to the difference threshold, wherever the pixel intensity difference between the peak and pre dynamic series fall below the difference threshold that data is excluded from the AngioMap. The default difference threshold is MED but by changing to LOW potentially the number of enhancing pixels included in the AngioMap can be increased. All patients proceeded to surgery within one month of their final MR examination. Surgical samples were histologically assessed and the longest diameter recorded. Bland Altman plots were generated between clinical CADstream and histology.



Enhancement threshold	Mean Difference	95% limits of agreement	False negative	False positive
50% MED	6.60mm	-38.66 to 51.86	8	0
30% MED	4.95mm	-40.80 to 50.70	6	0
30% LOW	-8.95mm	-66.40 to 48.50	2	1

Table 1.

Figure 1a. CADstream AngioMap generated from 50% MED thresholds overlaid onto subtracted peak dynamic series, note lack of enhancement in AngioMap. **Figure 1b.** CADstream AngioMap at same location as 1a generated from 30% LOW thresholds overlaid onto subtracted peak dynamic series, note obvious enhancement on AngioMap.

Results Post surgery two lesions were histologically confirmed to be complete responders while 18 lesions had residual disease. The results of the Bland Altman plot analysis are presented in Table 1. The number of false negative (patients with 0mm lesion on AngioMap but >0mm on histology) and false positive (patients with >0mm on AngioMap but 0mm on histology) cases for each enhancement threshold are also presented in Table 1. Figure 1 illustrates a false negative AngioMap result when 50% MED thresholds were used and the resulting AngioMap when the 30% LOW thresholds were utilised.

Conclusions Superficially, it may appear that due to its smaller mean difference and 95% limits of agreement that the 50% MED enhancement threshold out performed the 30% MED and 30% LOW thresholds. However, the 50% MED enhancement threshold also resulted in the highest number (8) of false negative cases. The number of false negative cases was only reduced to 6 when the enhancement threshold was reduced to 30 while still utilising the MED difference threshold. Once the difference threshold was reduced to LOW and combined with a 30% enhancement threshold the false negative rate dropped to 2. While the 30% LOW enhancement threshold demonstrated high sensitivity it also resulted in a general over estimation of the disease present and one false positive case. In conclusion this study has demonstrated that in the post chemotherapy setting, where varying degrees of vascular shutdown are expected, that by reducing the enhancement and difference thresholds from the pre-treatment settings the sensitivity can be increased resulting in fewer false negative results.

References ¹Vilanova J. *et. al.* RSNA 2005, ²Vilanova J. *et. al.* ARRS 2005, ³Lehman C. *et. al.* RSNA 2003.