

INVESTIGATION OF LOW- AND HIGH-GRADE TUMORS IN EVALUATING THE NEOADJUVANT CHEMOTHERAPY TREATMENT RESPONSE USING BREAST DCE MR IMAGES

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ABSTRACT

Breast cancer is the most predominant disease and foremost cause of cancer deaths in women worldwide, with treatment plans varying regardless of the grade and biology of the tumor. Neoadjuvant chemotherapy (NAC) is the standard clinical implementation to retrench the tumor size and escalate the breast-conserving rate. Dynamic contrast enhanced MR imaging (DCE-MRI) is an effective modality in analyzing the response during NAC treatment. However lower-grade cancer patients are slow growing tumors with a better prognosis, but higher-grade cancer patients aggressively grow and require effective treatment. So, it is necessary to investigate the grade specific response information during the NAC treatment. In this work, analysis of NAC treatment response on breast cancer patients is performed by investigating the low- and high-grade cancer patients separately using DCE MR images. Twenty-six patient data with three visits of NAC treatment is obtained from QIN BREAST and QIN BREAST-02 datasets from the openly available TCIA database. The mean intensity (MI) value is calculated from manually segmented tumor volumes at different visits for both low- and high-grade cancer patients. The results demonstrate that mean intensity values showed a statistical difference between Visit 1 & 3 in both low- and high-grade patients during NAC with $p \leq 0.05$. The percentage difference in mean intensity value between Visit 1 & 3 of high-grade subjects is observed to be high compared to low-grade subjects. Hence it appears that the high-grade breast cancer patients respond well to NAC treatment response compared to low-grade breast cancer patients.

Keywords: Breast Cancer, DCE MRI, Neoadjuvant Chemotherapy, Treatment Response, Tumor grades

INTRODUCTION

Breast cancer is a severe malignant disease among women worldwide. More than 2 million cases have been reported in 2020 [1]. Breast cancer prognosis prediction has become a more dominant task in recent oncology, particularly in preoperative chemotherapy [2]. Early detection aids in the improvement of therapeutic procedures to patients [3].

In the treatment of locally advanced breast cancer, preoperative Neoadjuvant chemotherapy (NAC) plays a key role in treatment [4]. NAC has been shown to reduce tumor size, downstage tumor, and increase breast conserving rate [5], [6]. Several studies have shown that Dynamic contrast enhanced MRI (DCE-MRI) provides greater predictive ability over conventional approaches in estimating residual tumor size following NAC. In clinical settings, tumor size changes are normally used to evaluate the response of breast cancer to NAC [7]. However extensive literature showed that quantitative methods, quantitative or semi-quantitative pharmacokinetic analysis can provide the response to NAC [8]–[11].