Lack of background parenchymal enhancement suppression in breast MRI due to nonadjuvant chemotherapy may be associated with inferior treatment response in hormone receptor positive breast cancer.

Background Parenchymal Enhancement (BPE) in Breast MRI

- Contrast enhancement of normal fibroglandular tissue
- Symmetric degree and distribution for both breasts
- Visual assessment in BI-RADS (4-point scale)
- Quantitative measurement in contrast arterial to background tumor
- Associated with breast cancer survival, treatment response to neoadjuvant chemotherapy (NAC) and future breast cancer risk

BPE & Hormonal status

Hormonal status significantly affects the degree of BPE, potentially due to a combination of mammary vascularity and activity. Non-suppressed BPE is more likely to be associated with mammary vascularity and activity. Non-suppressed BPE is associated with menstrual cycle, lactation, menopause, hormone replacement therapy hormone therapy (tamoxifen, aromatase inhibitors) etc.

Suppression of BPE during NAC

In most patients undergoing NAC, BPE may be suppressed by the nonspecific proliferative effects of chemotherapy on normal breasts and/or ovaries. During tamoxifen-based treatment cycles, BPE may exhibit a high degree of suppression. However, patients who exhibit equivalent or even stronger BPE post-NAC compared to pre-NAC may be associated with inferior treatment response.

Methods

Patients

- Includes 115 patients from 9 completed/graduated drug arms with pathological outcome
- Dynamic enhanced MRIs at four time points during NAC
  - T0: baseline
  - T1: early-treatment T2: mid-treatment T3: pre-surgery
- BRCA1/2 mutation status
- Patients with BRCA1/2 mutation received CPI treatment

Hypothesis

- We hypothesized that non-suppressed BPE in post-NAC may be associated with inferior treatment response.

Purpose

This study was designed to investigate the association between BPE suppression and treatment response as defined by pathologic complete response (HR-, pCR).

Methods

Automated Quantitative Measurement of BPE

- Fully automatic segmentation of contrast enhanced fat-saturated T1w CE (5 s) on a commercial 3T MRI system (MAGNETOM skyra; Siemens Healthineers)

Quality Score & High-quality Set

- Quality of automated differentiation of fibroglandular tissue
- Visual assessment by a radiologist using three point scoring (score 1 = good, score 2 = adequate, score 0 = poor)

High-quality set:

- % ∆BPE1_0 (n = 186)
- % ∆BPE2_0 (n = 452)

Statistical Analysis

Chi-squared test or Fisher’s exact test was used to examine the association between BPE suppression and pCR

Results

Study Cohort (High-quality set)

- In 452 patients, automated measurement of BPE suppression achieved high quality

Conclusions

- Our results confirmed our hypothesis in HR+ breast cancer: non-suppressed BPE at T2 and T3 showed association with inferior treatment response.
- The contralateral effect in HR- and HR+ cohort may reflect the influence of functional hormone suppression on treatment response.
- About half of the exams were excluded from BPE analysis. Improved image quality and automated image processing may increase yield.

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References: