The prediction of breast tumor response to chemotherapy by 3D-MRI images analysis and interpretation

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Introduction - Purpose

Breast cancer is the most common cancer among women in the world. In order to reduce the mortality rate to this cancer, it is necessary to have a powerful tools for a proper assessing of this disease during its treatment.

Breast tumor heterogeneous provide a significant information about its response to chemotherapy. Our purpose is to analyze this heterogeneity during treatment to quantify :

- **Responder regions**
- **Stable regions**
- **Non responder regions**

Methods and materials

Magnetic resonance imaging MRI (*Fig. 1*) provide a functional data of breast cancer disease (*Fig. 2*). In this work, we introduce our approach to quantify the intratumoral response of breast cancer to treatment, using 3D images from 54 patients treated at Jule Bordet institute in Brussels. Our method is based on two steps of image processing: segmentation (*Fig. 3*) and registration (*Fig. 4*) of two MRI exams, one before and other after the chemotherapy.
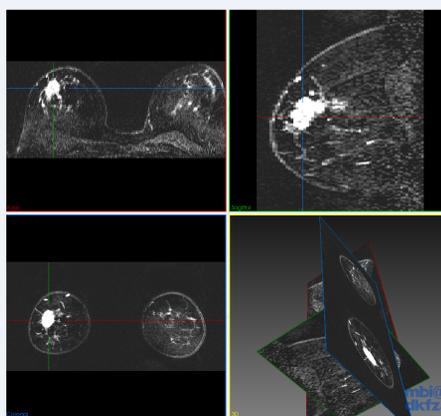

Fig. 1 : MRI technique
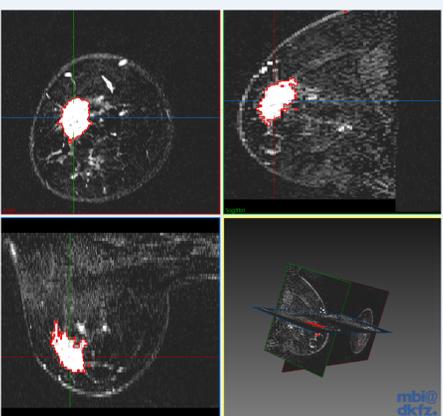

Fig. 2 : Functional 3D MRI images
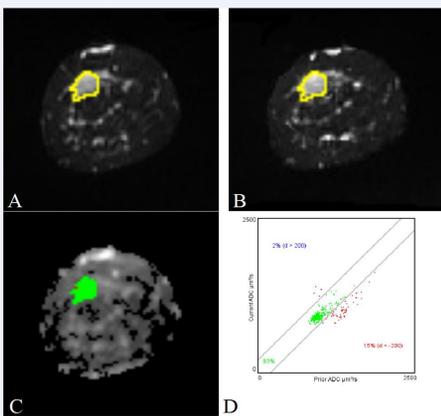

Fig. 3 : Breast tumor segmentation

Fig. 4 : Breast tumor registration

Results

Input

3D breast image before treatment

3D breast image after treatment

Pretreatment

N4ITKBiasCorrection

Semi-automatic segmentation

Yes — Full segmentation — No

Treatment

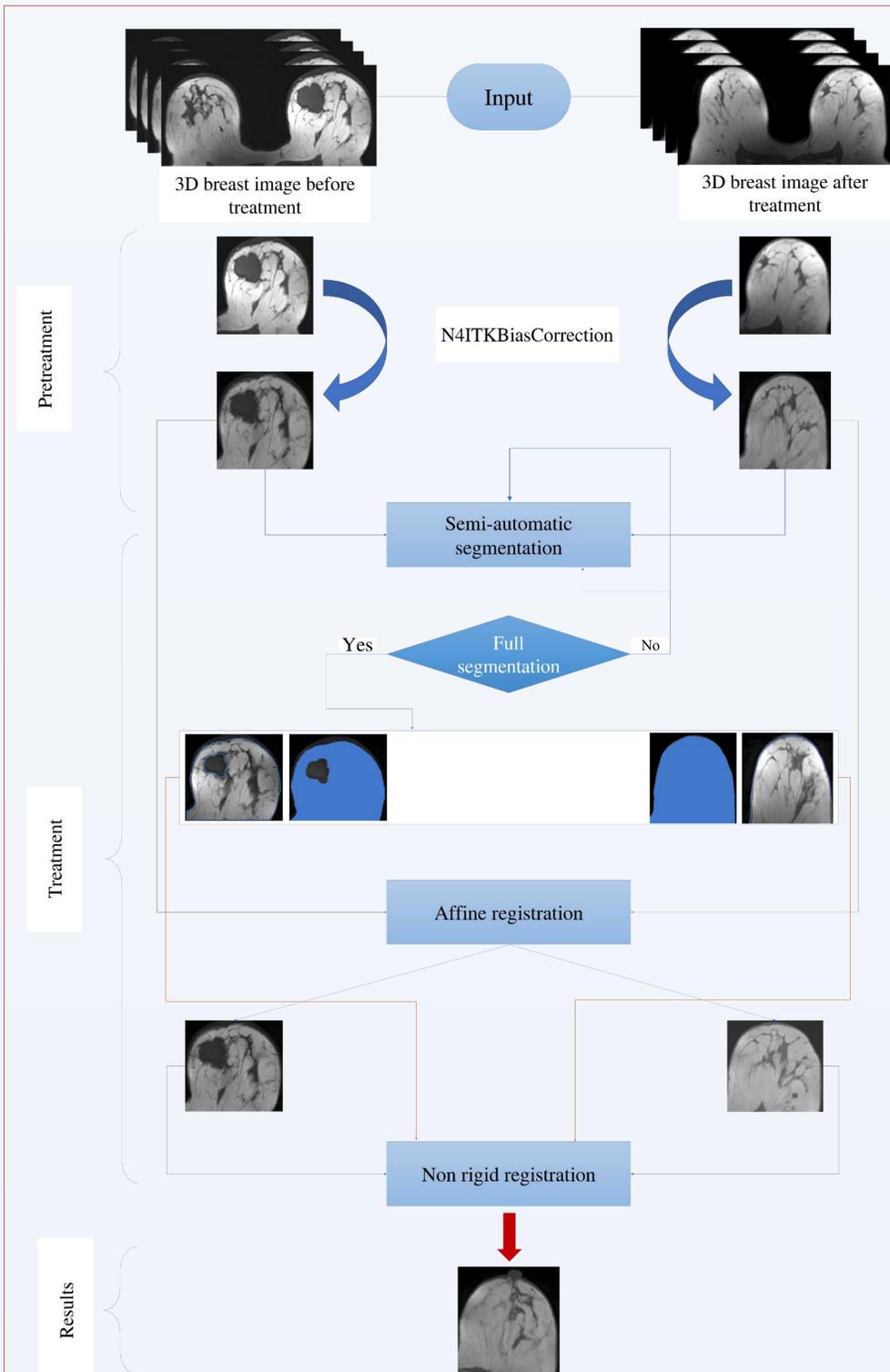Affine registration

Non rigid registration

Results

Fig. 5 : Non rigid transformation results

Conclusion & Perspectives

✓ This work aims to adapt the breast shape after the treatment to that before treatment by non rigid registration techniques.

✓ Our perspectives are to :

✓ Analyze and quantify intra tumor responders, non responders and stable regions during chemotherapy.

✓ Apply our method to other MRI modalities as contrast and diffusion sequences

✓ Help radiologists and oncologists to make a quick decision, and to provide a hyper selective biopsy, Thanks to the differentiation between the most aggressive and the least aggressive intratumoral regions.