Can a single sequence chest MRI scan without contrast replace chest CT in the preoperative planning of breast implants surgery?

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In the preoperative assessment of patients requesting breast augmentation, chest wall analysis is a valuable element.

If a breast asymmetry is detected, an underlying chest wall deformity had to be taken in account.

The presence of chest wall abnormality plays a crucial role in the choice and type of the implant and in its placement.

Failing to recognize chest wall asymmetries can lead to suboptimal results in breast augmentation surgery: the asymmetry may first became evident postoperatively or magnified by the surgical procedure.

Some authors, in the last years, have pointed out the importance of preoperative chest wall analysis prior to breast augmentation to avoid suboptimal surgical and aesthetic outcomes and dissatisfaction in patients.

Hirsch et al. in particular stressed out this idea, analyzing standard chest computed tomography (CT) scan and showing the high prevalence of chest wall asymmetries and the surgical implications of them.

Although there are studies concerning the use of CT to objectively assess breast and chest measures to provide customized breast augmentation, we found no report that describes the use of MRI for such assessment.

This study describes the use of magnetic resonance imaging (MRI) as a feasible, fast and secure technique to evaluate chest wall asymmetry.

MRI scan of the chest wall can help surgeons planning breast augmentation and predict postoperative results.
Methods and Materials

Our study is based on the concept and analysis emerged in the work of Hirsch et al. But in agreement with the surgeons, and considering the typology of patients, we judged MRI a better option for the evaluation of chest asymmetries.

Between May and December 2011, 15 patients underwent chest/breast MRI scan. All patients were female. The average age was 38.5 years.

All patients showed on clinical examination some degree of breast/chest wall asymmetry. No patient had previously undergone to major thoracic surgery or had thoracic trauma.

All scanning were performed on a 1.5 T scanner just using a single T1 SE sequence, without fat tissue signal suppression, making therefore the examination very fast. No contrast was administered. Breast and chest wall, till the vertebral column, were included in the scan.

For each patient measurements were taken to assess the overall shape of the chest wall and to establish the presence of asymmetry.

- The maximum thoracic transverse diameter (lateral thoracic width) was measured between the most lateral internal points of the thoracic cage (Fig. 1 on page 5).
- On each side of the chest, the maximum anterior-posterior diameter was also measured between the most anterior and the most posterior point of the thoracic cage (Fig. 1 on page 5).

These three measurements were helpful to define the overall thoracic shape.

Three internal thoracic angles were also calculated.

- The anterior thoracic angle (A) was helpful to evaluate lateral width asymmetry. For each side this angle was measured from the most lateral point on the thoracic cage to the ipsilateral side of the sternum to the most posterior point of the thoracic cage (Fig. 2 on page 5).
- The posterior thoracic angle (P) was helpful to evaluate the degree of vertebral body-sternum alignment. For each side this angle was measured from the most lateral point to the most posterior point on the thoracic cage to the ipsilateral side of the sternum (Fig. 3 on page 6).
- The lateral thoracic angle (L) was used to evaluate overall shape and anterior-posterior deformity. This angle was bilaterally measured from the lateral border of the ipsilateral side of the sternum to the most lateral point
on the thoracic cage to the most posterior point of the internal posterior wall (Fig. 4 on page 7).

The approximate plane of breast projection was also calculated.

• This plane of projection was calculated tracing a line from the lateral side of the sternum to the lateral thoracic wall, approximately parallel to an ideal tangent to the anterior chest wall and then tracing a line perpendicular to the first (Fig. 5 on page 8).

This plane shows how the breasts will project anteriorly and cranially.

In sloped chest wall breasts tend to project laterally, while in flat chest wall they tend to project anteriorly.

Breast transverse diameters, volume and level of inframammary fold were obtained.

All measurements were taken where chest wall presented the widest dimensions, as established visually in the scans.

Clinical example

A woman of 41 years underwent breast augmentation without a preoperative chest wall analysis. Chest wall shape and asymmetries were not systematically investigated before surgery.

Postoperatively the presences of chest asymmetries were magnified by the implants, and the aesthetic result was suboptimal. The left breast projected laterally and the left inframammary fold was more caudal compared to the right side (Fig. 6 on page 9).

The patient, dissatisfied, opted for a new corrective surgery. At our institution the patient underwent chest wall MRI for a preoperative analysis. The measurements on the MRI scan demonstrated a right-left difference in the anterior-posterior chest diameter and in the approximate plane of breast projection (Fig. 7 on page 10, Fig. 8 on page 11).

The individualized breast surgery after MRI corrected the left breast projection and the level of the left inframammary fold: the aesthetic outcome was optimal (Fig. 9 on page 12).
Fig. 1: Thoracic transverse diameter and anterior-posterior diameters.

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Fig. 2: Anterior thoracic angle (A).

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**Fig. 3:** Posterior thoracic angle (P).

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Fig. 4: Lateral thoracic angle (L).

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**Fig. 5:** Approximate plane of breast projection.

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Fig. 6: Suboptimal postoperative result: the left breast tends to project laterally and the left inframammary fold is more caudal compared to the right side.
**Fig. 7:** MRI scan shows a right-left difference in the anterior-posterior chest diameter.

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Fig. 8: MRI scan shows the right and left approximate plane of breast projection.

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**Fig. 9:** Same patient of Fig. 6 after a new corrective surgery: the left breast projection and the level of the left inframammary fold were corrected.

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Results

Almost all patients showed some degree of asymmetry between the right and left side of the thorax and variations in the chest wall contours. MRI provided detailed and accurate data.

Even though our number of patients was smaller than the series of Hirsch et al., the preliminary data obtained in this study seem to confirm the observations of Hirsch: all patients have some degree of right-left asymmetry in the three angular measurements and in the anterior-posterior chest diameter.

In this poster we decided to don't report all measurements and data emerged in our study, that are in itself of little interest; we report only a table that summarizes the differences, expressed in Centimeters, emerged between the right and left anterior-posterior chest diameter and the average difference found between them (Table 1 on page 15).
Table 1: Differences between right (R) and left (L) Anterior-Posterior diameter and the average difference between them (Measurements expressed in Centimeters).

<table>
<thead>
<tr>
<th># Patients</th>
<th>AP Diameter (R)</th>
<th>AP Diameter (L)</th>
<th>R-L Diameters Differences</th>
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<td>15.06</td>
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<tr>
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<td>15</td>
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<td>1.60</td>
</tr>
</tbody>
</table>

| 14.27 | 14.80 | 0.710 | Average |

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Conclusion

The findings emerged in this preliminary study revealed the value of breast and chest wall MRI scan in patients presenting with suspected chest wall asymmetry.

It is of great value to understand the asymmetry and the variations in chest wall prior to breast augmentation because the breast projection and degree of symmetry will vary postoperatively, becoming even magnified.

The analysis of the plane of breast projection is particularly valuable because helps surgeons to understand the tendency of each breast to project laterally of anteriorly.

Evaluation of the data obtained from the scans helps physicians to easily determine implant and surgery type and to eliminate the major part of post-operative complaints and patient dissatisfaction, ensuring that best aesthetic results are obtained for each patient.

MRI study is a particularly valuable technique in young women because there is no use of ionizing radiation. A remarkable point is that there was no need for intravenous contrast administration.

As remarked by Hirsch it not easy to determine the clinical implications of the measured asymmetries, but in our opinion it is important to consider a chest MRI scan in women undergoing breast augmentation to achieve a optimal result by highly customized surgical approach.
References


