

Comparison of preoperative ultrasound, mammographic, and MRI measurement of invasive lobular carcinoma with operative histology

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Background

Pre-operative assessment of breast cancer patients involves physical examination and multi-modality imaging. Accurate pre-operative assessment is required to optimise treatment regimens including surgical planning. Lobular carcinoma is often infiltrative and therefore difficult to measure accurately on all imaging modalities.

Aim

To determine the accuracy of imaging measurements in invasive lobular cancer patients who had undergone all 3 imaging modalities preoperatively, using final surgical pathology measurement as a gold standard with which to compare.

Methods

- MRI workstation records between January 2013 and December 2014 were used to identify all patients with invasive lobular carcinoma who had undergone MRI as part of their pre-operative assessment.
- Trust electronic imaging and pathology records were used to extract the longest axis tumour dimensions for each imaging modality and final surgical pathology.
- The recorded measurements were compared.
- Regression analysis and descriptive statistics were performed.

Results

Of 110 women diagnosed with invasive lobular carcinoma, 71 were excluded from subsequent analysis (Table 1). The remaining 39 patients that were included all underwent preoperative ultrasound, mammogram and MRI, and had surgical pathology for correlation.

Patients excluded from initial cohort	Number
No surgery	17
Mastectomy (therefore no MRI)	24
No MRI for other reason e.g. claustrophobia, impaired renal function	14
Post-neoadjuvant chemotherapy	1
Unable to measure mass on all 3 modalities	12
Multifocal disease on imaging and/or pathology	3

Table 1: Reasons for exclusions

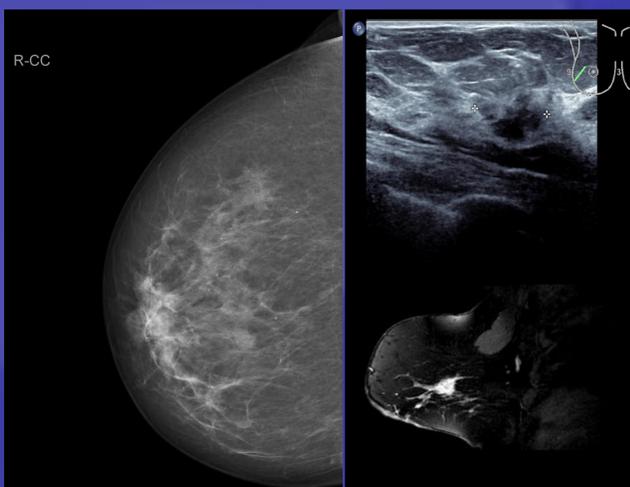


Figure 1: Case example illustrating difficulties in accurate size measurement: Mammographic size 10 mm, US 16 mm, MRI 23 mm. Final pathological size 20 mm.

Results continued:

The range of lesion size for each modality were: 5-35mm (ultrasound), 5-70mm (mammogram) & 7-45mm (MRI). The range of invasive lobular cancer size from the final surgical excision pathological specimens was 2-40mm.

Maximum tumour dimension on MRI had the highest correlation of the three imaging modalities when compared with final histological size (mammogram $r^2 = 0.43$, ultrasound $r^2 = 0.62$, MRI $r^2 = 0.68$). Figures 2 and 3 show the correlation for mammography and MRI versus pathological size, respectively.

Multivariate regression showed that the combination of ultrasound, mammogram and MRI was the most effective way of estimating size of malignancy in invasive lobular carcinoma ($r^2 = 70\%$, versus $r^2 = 61\%$ for the combination of ultrasound and mammogram). Further analysis showed that ultrasound had a tendency to underestimate disease measurement, whereas MRI had a tendency to overestimate it (data not shown).

Figure 2: Poor correlation between mammographic and pathological size ($r^2 = 0.43$). Mammographic measurement correlated very poorly with final surgical pathology, with the lowest r^2 value of the three imaging modalities.

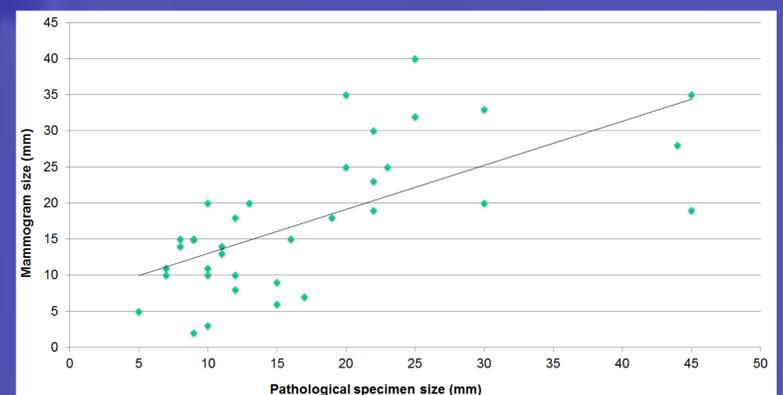
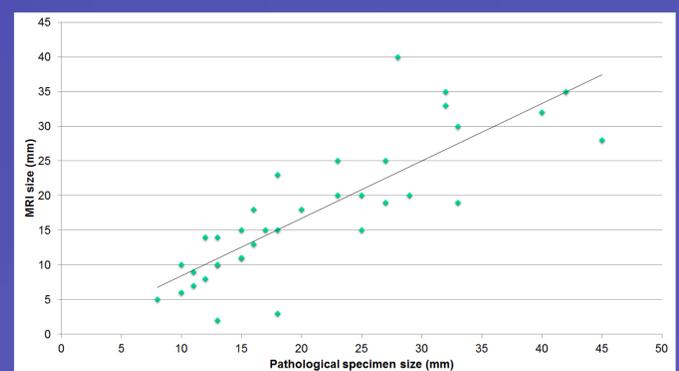


Figure 3: Correlation between MRI and pathological size: MRI correlated best with final surgical pathology, with the highest r^2 value ($r^2 = 0.68$) of the three imaging modalities.



Conclusion

Mammographic measurement correlates most poorly with invasive lobular cancer size at final surgical pathology, with MRI showing the best correlation of the three imaging modalities. The combination of ultrasound, mammogram and MRI most effectively predicts tumour size at final surgical pathology. Ultrasound tends to underestimate invasive disease size, as opposed to MRI where there is a tendency toward size overestimation.

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