Sentinel node imaging: Validation of new technique to compare SPECT/CT volume uptake with histopathology

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SPECT/CT for Breast Sentinel Nodes

- Planar lymphoscintigraphy is the commonly used imaging modality.

- SPECT/CT is used for anatomical location of sentinel nodes in breast cancer patients pre-operatively and may be used with Methylene Blue Dye and a hand-held gamma probe intra-operatively.

- CT component data is used for attenuation correction and anatomical localisation of nodes.
Research Aim

- The purpose of this study was to assess if semi-quantification of tracer uptake on SPECT/CT could correlate with metastatic infiltration of SLNs.

- To explore whether tracer uptake on SPECT/CT could have diagnostic implications.
Method

- 95 consecutive patients over one year.

- 0.4ml 40MBq $^{99m}$Tc. Nanocolloid was injected in periareolar region 20 minutes prior to imaging.

- Low dose CT; 120Kv; 2.5mAmps; 10mm sections; Coronal, sagittal and axial reconstructions.

- Attenuation correction with CT.
Method

- Surface radiation dose 105mGray/cm$^2$; (<0.5-0.9 mSieverts).

- Xeleris software (GE) was used to quantify the volume uptake (counts per pixel) in both the sentinel node and injection site.

- A percentage volume uptake in the sentinel node (SN%) was then calculated.
Method

- SN% was statistically compared with histopathology to identify any trends using a Pearson’s Correlation Analysis.
- Finally, SN% was subdivided into increments from 0 to 4.000.
- Patients were then categorised by their histopathological diagnosis.
How was Volume Uptake Quantified?

- SLN thickness was calculated by identifying the number of horizontal sections through the node.
- Finally a region of interest (ROI) was drawn around the SLN.
- Through a set of Xeleris tools a volume uptake (counts per pixel) was derived.
- This was repeated for the injection site and a ratio of both uptakes obtained (SN%).
- This provided a semi-quantitative uptake value for the SLN.
## Results

- **Total number of patients**: 95

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<th>Histopathology Positive</th>
<th>Histopathology Negative</th>
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<tbody>
<tr>
<td>Visualised</td>
<td>34 (TP)</td>
<td>47 (FP)</td>
</tr>
<tr>
<td>Non-Visualised</td>
<td>1 (FN)</td>
<td>13 (TN)</td>
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The results showed that the test was highly sensitive (97%) but not very specific.

13 out of the 14 non-visualised SLN patients were negative histopathologically. Yielding a NPV of 93%.

The Pearson correlation analysis yielded a relatively high correlation between negative/positive histopathology and SN% at –0.659 and 0.677, respectively.
Results cont...
Conclusion

- SPECT/CT has shown a clear correlation in identifying histopathologically negative disease in relation to SN% values.

- However, as the SN% is increased to values greater than 0.500 it became increasingly difficult to distinguish between histopathologically positive and negative nodal disease.
The high sensitivity suggests that the imaging modality may be of value in predicting SLN metastatic infiltration.
Case 1

- Patient X presented with invasive ductal carcinoma of breast.
- SPECT/CT illustrated an SN% of 0.044%.
- Histopathology later confirmed negative nodal disease.
Case 2

- Patient Y presented with infiltrative ductal carcinoma Grade 3 of breast.
- SN% was 4.091%
- Histopathology later confirmed active metastatic disease in SLN.
Discussion Points

- The study is unique as there is no literature available on quantification of sentinel node imaging.
- The clinical implications; SPECT/CT may offer additional prognostic information to surgeons, and potentially pre-empt more invasive investigations for selected breast cancer patients.
  - Thereby reducing morbidity from locoregional radical lymphadenopathy.
Discussion Points Cont…

- Further pilot studies are recommended within the field.
  
  1. Prospective SPECT/CT study that attempts to predict the histopathological outcome.
  2. Study that takes into account variables, such as, age, weight, side of lymphatic drainage, type of breast cancer, etc.
THANK YOU

Questions?