Factors that Influence Incomplete Excision after Breast Conserving Surgery

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Breakthrough Research Unit Edinburgh
What's the one word you hate to hear from your Pathologist
How can we avoid incomplete excisions?

Here is how I do wide local excisions
Excision of Breast Cancer
6 o'clock
Right Breast
Result after Surgery
Result after Surgery
Wide Excision Including Skin in a 92 year old under local anaesthesia
Result at 6 months
Importance of Specimen Radiography
1100 BCS Patients Edinburgh 2000-4

5 Year Recurrence Rate

- Front/Back Margin <1mm: 2.5
- Margin 1-5 mm: 2.0
- Margin 5-10mm: 1.5
- Re excision negative: 2.4
1100 BCS Patients Edinburgh 2000-4

<table>
<thead>
<tr>
<th>Margin Positive</th>
<th>5 year IBTR</th>
<th>8 year IBTR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep Margin</td>
<td>0.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Anterior Margin</td>
<td>3.7</td>
<td>3.7</td>
</tr>
<tr>
<td>Radial</td>
<td>9.3</td>
<td>9.3</td>
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Years of Follow up
Diplomacy is the art of telling plain truths without giving offence
How many incomplete excisions are due to incompetent surgery and how many are related to other factors?
This is what I mean by incompetence
Patients and Methods

• BCS patients at EBU 2008-9
  - No prior treatment
• Rate of incomplete excision 18.75%
• Case control study
  - 2:1 Complete excisions CE n= 193
  - Incomplete excisions IE n=118
• Total 311 patients: 62% CE, 38% IE
  - 289 USS size
  - 290 Mammography size
  - 276 Both
Hypothesis

- Incomplete excision much more likely when whole tumour size (pathology size) including invasive and in situ disease is significantly larger than imaging size
Pathology

• Involved radial margins <1mm

• Size of invasive cancer mm

• Extent of DCIS outside cancer mm
  ➢ DCIS component

• Total tumour size adding invasive and in situ mm
Factors Analysed

<table>
<thead>
<tr>
<th>Clinical Variables</th>
<th>Pathological Variables</th>
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<tbody>
<tr>
<td>Age at diagnosis</td>
<td>Tumour dimensions</td>
</tr>
<tr>
<td>Menopausal status</td>
<td>Maximum diameter of the invasive component</td>
</tr>
<tr>
<td>Density of breast tissue</td>
<td>Maximum tumour diameter including CIS</td>
</tr>
<tr>
<td>Smoking history</td>
<td>Distance to the excision margin</td>
</tr>
<tr>
<td>HRT history</td>
<td>Distribution of CIS outwith or within the invasive component</td>
</tr>
<tr>
<td>Parity</td>
<td>Tumour type</td>
</tr>
<tr>
<td>Mode of presentation</td>
<td>Tumour shape</td>
</tr>
<tr>
<td>Palpability of tumour</td>
<td>Presence of multifocality</td>
</tr>
<tr>
<td>Maximum tumour diameter on mammography</td>
<td>ER status</td>
</tr>
<tr>
<td>Tumour dimensions on mammography</td>
<td>PR status</td>
</tr>
<tr>
<td>Maximum tumour diameter on USS</td>
<td>HER-2 status</td>
</tr>
<tr>
<td>Tumour dimensions on USS</td>
<td>Presence of lymphovascular invasion</td>
</tr>
<tr>
<td>Tumour stage (1-4)</td>
<td>Presence and type of calcification</td>
</tr>
<tr>
<td>N stage (0-1)</td>
<td>Highest DCIS grade</td>
</tr>
<tr>
<td>Number of nodes examined</td>
<td>DCIS growth pattern</td>
</tr>
<tr>
<td>Number of nodes involved</td>
<td></td>
</tr>
<tr>
<td>Type of BCS</td>
<td></td>
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Mean Underestimation of Final Pathology Size by Imaging

- 11.69mm for Mammography
- 17.18mm for Ultrasonography
Excision Rate vs Difference between Mammographic and Pathology Size

Size Difference between Mammographic Size and Final Pathology Size
Excision Rate vs Difference between Ultrasonographic and Pathology Size

Size Difference between USS Size and Final Pathology Size

Hazard Ratio

- <1mm
- 2-5mm
- 6-10mm
- 11-20mm
- 21-40mm
- >40mm
Complete Excision Rate vs Invasive Pathology Size

Size of Invasive Breast Cancer

Hazard Ratio

- 1-5mm
- 6-10mm
- 11-20mm
- 21-40mm
- >40mm
Complete Excision Rate vs Total Pathology Size (Invasive + In situ)

Hazard Ratio

Total Pathology Size of Invasive + In situ Breast Cancer

- 1-5mm
- 6-10mm
- 11-20mm
- 21-40mm
- >40mm
Extent of DCIS out with Invasive Cancer

Hazard Ratio

Extent of DCIS out with the Invasive Breast Cancer
Other Factors Associated in Univariate Analysis

More likely to be incomplete excised

- Multifocal Cancer
- High grade vs low grade DCIS outwith cancer
- Stereo wire localisation
- Invasive Lobular Cancer

More likely to be completely excised

- Circumscribed cancers
Multifocality and High Grade DCIS

% Incomplete Excision

- Multifocal: 31%
- High Grade DCIS: 16%

Yes: Multifocal 31%, No: Multifocal 15%
Yes: High Grade DCIS 16%, No: High Grade DCIS 10%
Best Fit Model For Predicting Incomplete Excision

- 3 Factors Important
  - Multifocality
  - Extent of DCIS outwith main cancer
  - Mismatch between final path size and USS size
Underestimation of size by USS
Final Path size – USS size vs CE Rate

<table>
<thead>
<tr>
<th>Path – USS Size</th>
<th>% Complete Excision Expected</th>
<th>% of all cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤1mm</td>
<td>9.6%</td>
<td>41%</td>
</tr>
<tr>
<td>2-5mm</td>
<td>9.2%</td>
<td>22%</td>
</tr>
<tr>
<td>6-10mm</td>
<td>27%</td>
<td>14%</td>
</tr>
<tr>
<td>11-20mm</td>
<td>67%</td>
<td>9%</td>
</tr>
<tr>
<td>21-40mm</td>
<td>64%</td>
<td>10%</td>
</tr>
<tr>
<td>41mm+</td>
<td>100%</td>
<td>4%</td>
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Best Fit Model for Predicting Incomplete Excision

- Prediction accuracy 83%
- Predicts incomplete Excisions in 67%
- Almost two thirds of Incomplete excisions are due to factors outwith the surgeons control
- Only a third of re excisions will be prevented by techniques such as specimen radiography, intra op ultrasound and better surgery
Devices To Improve Excision Rate

Dune Medical Device – Margin Probe
- sucks in tissue - high frequency sonar (gHZ) launches a wave into the tissue for about 1mm and measures reflection from the tissue

L S Biopath – Touch
- Electrodes penetrate to desired depth (1-5mm) radiofrequency current passed into tissue with analysis of how tissue conducts and stores charge
Surgical Incompetence
Rarely a factor in failure to excise Breast Cancers by BCS