Intraoperative Ultrasound

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No disclosures
Ultrasound in breast surgery

- Primary examination of breast pathologies
  - Breast
  - Lymph nodes
- Monitoring during neoadjuvant chemotherapy
- Intraoperative ultrasound (IOUS)
- Surveillance/Follow-up
# IOUS vs. preop. wire-localization

<table>
<thead>
<tr>
<th>Author / PY</th>
<th>N</th>
<th>Re-excision rate</th>
<th>Re-excision rate</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snider HC/ 1999</td>
<td>44</td>
<td>18%</td>
<td>18%</td>
<td>n.s.</td>
</tr>
<tr>
<td>Rahusen FD/ 2002</td>
<td>49</td>
<td>11%</td>
<td>45%</td>
<td>P = .007</td>
</tr>
<tr>
<td>Haid A / 2007</td>
<td>360</td>
<td>19%</td>
<td>38%</td>
<td>P &lt; .00228</td>
</tr>
<tr>
<td>Krekel NM / 2011</td>
<td>169</td>
<td>4%</td>
<td>21%</td>
<td>P = .023</td>
</tr>
<tr>
<td>Barentsz MW / 2012</td>
<td>258</td>
<td>6%</td>
<td>7%</td>
<td>n.s.</td>
</tr>
</tbody>
</table>
# IOUS vs. palpation guidance

<table>
<thead>
<tr>
<th>Author / PY</th>
<th>N</th>
<th>Re-excision rate IOUS</th>
<th>Re-excision rate Palpation</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moore MM / 2001 *</td>
<td>51</td>
<td>4%</td>
<td>29%</td>
<td>$P &lt; .05$</td>
</tr>
<tr>
<td>Fisher CS / 2011</td>
<td>197</td>
<td>23%</td>
<td>25%</td>
<td>n.s.</td>
</tr>
<tr>
<td>Eichler C / 2012</td>
<td>250</td>
<td>4%</td>
<td>17%</td>
<td>$P = .002$</td>
</tr>
<tr>
<td>Krekel NMA / 2013 *</td>
<td>134</td>
<td>3%</td>
<td>17%</td>
<td>$P = .0093$</td>
</tr>
<tr>
<td>Eggemann H / 2014</td>
<td>335</td>
<td>12%</td>
<td>24%</td>
<td>$P = .004$</td>
</tr>
<tr>
<td>Karanlik H / 2015</td>
<td>164</td>
<td>6%</td>
<td>17%</td>
<td>$P = .03$</td>
</tr>
</tbody>
</table>

* Randomised trial
## IOUS and resection volume

<table>
<thead>
<tr>
<th>Author / PY</th>
<th>N</th>
<th>Resection volume (cm³) IOUS</th>
<th>Resection volume (cm³) other methods</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snider HC/ 1999</td>
<td>44</td>
<td>63</td>
<td>81</td>
<td>n.s.</td>
</tr>
<tr>
<td>Moore MM / 2001 *</td>
<td>51</td>
<td>104</td>
<td>114</td>
<td>n.s.</td>
</tr>
<tr>
<td>Krekel NMA / 2011</td>
<td>152</td>
<td>71</td>
<td>55</td>
<td>n.s.</td>
</tr>
<tr>
<td>Krekel NMA / 2013 *</td>
<td>134</td>
<td>38</td>
<td>57</td>
<td>$P = .002$</td>
</tr>
<tr>
<td>Eggemann / 2014</td>
<td>335</td>
<td>103</td>
<td>116</td>
<td>n.s.</td>
</tr>
</tbody>
</table>
IOUS and cosmetic outcome

<table>
<thead>
<tr>
<th></th>
<th>IOUS</th>
<th>Palpation</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physician panel</strong></td>
<td></td>
<td></td>
<td>P = .067 (trend)</td>
</tr>
<tr>
<td>Excellent</td>
<td>14</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>51</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td>22</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>13</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td><strong>Patient satisfaction</strong></td>
<td></td>
<td></td>
<td>n.s.</td>
</tr>
<tr>
<td>Excellent</td>
<td>26</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>54</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td>7</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>13</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

IOUS for Breast Conservative Surgery

- IOUS decreases significantly re-excision rate
- IOUS decreases significantly resection volume
- IOUS improves cosmetic outcome (trend)

Additional advantages

- Improved safety for surgeon
  - Choice of skin incision
  - Anatomical orientation during surgery
  - Ultrasound of the specimen

- Saving time
- Saving costs

Limitations

- Underestimation of tumor size
- DCIS-parts of tumors not visible
- Physician`s experience
- Device
Intraoperative Ultrasound (IOUS)

- **Breast**
  - Localization
    - Masses
    - After stereotactic vacuum assisted biopsy
    - After neoadjuvant chemotherapy
  - Extension of the tumor
- **Axilla**
  - Localization
    - Suspicious lymph node in addition to sentinel node
    - Originally positive lymph nodes after neoadj. Chemoth.
IOUS for masses

- Marking on the skin
- Wire localization
IOUS after neoadjuvant chemotherapy

- Positioning of a HydroMARK®-clip in the tumor
- Neoadjuvant Chemotherapy
- Surgery
  - Intraoperative Localization
  - Excision
  - Specimen imaging
IOUS for suspicious microcalcifications

- Screening mammography
- Stereotactic vacuum assisted biopsy + HydroMARK®-clip
- Preoperative mammography and ultrasound
- Surgical excision
  - IOUS-guided wire-localization
  - Specimen imaging
Advantage of IOUS

- Omission of preoperative wire localization
  - Less logistic challenges
  - Time saving
  - Less stress for
    - patient
    - surgeon
  - More safety
IOUS for axillary lymph nodes I

- Policy has changed since Z0011-trial
  - 1-2 sonographically suspicious lymph nodes do not lead to axillary lymph node dissection
  - But must be removed with Sentinel biopsy
- I.o. wire-localization of the suspicious node
- Additional removement in the framework of sentinel biopsy if it is not the sentinel node
- Sensitivity increasing (89 ➔ 99%)

IOUS for axillary lymph nodes II

- In the framework of neoadjuvant chemotherapy.
- Biopsy of suspicious lymph nodes
- Marked by a HydroMARK®-clip
- If lymph nodes become unsuspicious by neoadjuvant chemotherapy, the marked nodes will be removed by sentinel node biopsy
- Increasing sensitivity (78 ➔ 96%)

Take home message

- IOUS is very helpful for safe surgery in the
  - Breast
  - Axilla
- IOUS decreases re-excision rate
- IOUS improves cosmesis by less resection volume
- IOUS safes time and costs