Innovations in Nipple Sparing Mastectomy

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No disclosures
Changing issues in breast cancer management

- Early detection and improved treatment have resulted in many healthy, long term survivors
- Consequences of cancer treatment, QOL issues more important than in past
- Local and distant recurrence risk continues 10+ years
- Ongoing risk of new primary cancers

Breast Conservation vs. Mastectomy

- 20 year follow-up: lumpectomy and mastectomy provide equivalent survival
- Technical improvements in lumpectomy and radiation
  - 10-year local recurrence rates now 2-5%
  - further reduces relative benefit of mastectomy
Who *needs* a mastectomy in 2014?

- Unable to obtain clear lumpectomy margins with an acceptable cosmetic result
- Cancer in patient who cannot receive radiation
  - New cancer in a previously irradiated breast
  - Need to treat during pregnancy
  - Exception for elderly
- Breast cancer in a BRCA mutation carrier
- High risk patients for risk reduction

“But my friends say I should just take both breasts off”

Concerns that lead to choosing mastectomy

- Positive margins/need for re-excision
- Radiation side effects/complications
- Future breast cancer risk
- Symmetry concerns
Choosing between lumpectomy and (bilateral) mastectomy

- Tumor factors
- Cosmetic considerations
- Risk and follow-up considerations
- Patient preference

Skin sparing mastectomy: same local and distant recurrence as no reconstruction
Skin sparing mastectomy: 
nipple reconstruction, contralateral mastopexy

Time for nipple-sparing mastectomy?

- Evidence of safety of skin-sparing mastectomy
- 80% of women undergoing breast reconstruction choose nipple reconstruction
- Superior cosmetic result with nipple-sparing

Bilateral Nipple-sparing Mastectomies, Implant Reconstructions
The nipple is just another margin

• Increasing evidence for oncologic safety of nipple sparing with clear margins

• Remaining issues are largely technical
  – Incision placement
  – Nipple margin assessment
  – Complication rates
  – Cosmetic outcomes

Nipple recurrence rates are low after nipple sparing mastectomy for breast cancer

<table>
<thead>
<tr>
<th>Year</th>
<th>N</th>
<th>% Local rec</th>
<th># NAC rec</th>
<th>F/U mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petit</td>
<td>2012</td>
<td>1001</td>
<td>3.6</td>
<td>7*</td>
</tr>
<tr>
<td>Benediktsson</td>
<td>2008</td>
<td>216</td>
<td>20.8</td>
<td>0</td>
</tr>
<tr>
<td>Vaughan</td>
<td>2007</td>
<td>206</td>
<td>5.3</td>
<td>0</td>
</tr>
<tr>
<td>Kim</td>
<td>2010</td>
<td>152</td>
<td>2.0</td>
<td>2</td>
</tr>
<tr>
<td>Paepke</td>
<td>2009</td>
<td>109</td>
<td>2.0</td>
<td>0</td>
</tr>
<tr>
<td>Jensen</td>
<td>2011</td>
<td>99</td>
<td>3.0</td>
<td>0</td>
</tr>
<tr>
<td>Gerber</td>
<td>2009</td>
<td>60</td>
<td>11.7</td>
<td>1</td>
</tr>
</tbody>
</table>

* Recurred as Paget's disease
Nipple-sparing mastectomy: Nipple necrosis: Rates decrease with experience

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Nipple Viability</th>
</tr>
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<tbody>
<tr>
<td>Petit 2009</td>
<td>1001</td>
<td>Total necrosis 3%, Partial necrosis 5.5%</td>
</tr>
<tr>
<td>Sacchini 2006</td>
<td>192</td>
<td>4.5% loss, 6.8% minimal</td>
</tr>
<tr>
<td>Crowe 2008</td>
<td>149</td>
<td>Partial loss 1.3%</td>
</tr>
<tr>
<td>Garwood 2009</td>
<td>106</td>
<td>Partial + total 5%</td>
</tr>
<tr>
<td>Caruso 2006</td>
<td>50</td>
<td>2% loss</td>
</tr>
<tr>
<td>Stolier 2008</td>
<td>82</td>
<td>None lost. 2% minor skin edge</td>
</tr>
<tr>
<td>Regolo 2008</td>
<td>70</td>
<td>None lost</td>
</tr>
<tr>
<td>Wijayanayagam 2008</td>
<td>64</td>
<td>Total necrosis 4%, Partial necrosis 16%</td>
</tr>
</tbody>
</table>

Nipple-sparing: Challenges 2014

- Patient selection/Oncologic safety
  - Acceptably low risk of nipple involvement
  - Proper margin assessment

- Technical - competing goals
  - Remove all ductal tissue at risk
  - Maintain nipple viability, healthy flaps

- Cosmetic – nipple location
Technical factors:
Duct excision vs. vessel preservation

Nipple Anatomy

- Nipples from 129 consecutive mastectomies
  - 3mm sections, location and size of ducts and vessels
  - 3 nipples 50 micron sections, 3D reconstructions

- Findings
  - Median number of ducts 23 (19-28)
  - Central duct bundle narrows
  - **Uniform duct bundle diameter: 5 - 5.5 mm**

Rusby JE, Brachtel EF, Michaelson JS, Koerner FC, Smith, BL
Br Ca Res and Treat, 106:171, 2007
3D Nipple Anatomy

E. Ducts with common orifice
D. Narrow ducts at tip
C. Ducts arising from the areola
B. Waist
A. Duct bundle

Rusby JE, Brachtel EF, Michaelson JS, Koerner FC, Smith, BL
Br Ca Res and Treat, 2007

Multiple ducts empty into a common orifice on the nipple surface

Location of blood vessels relative to nipple ducts: Factor VIII staining


Nipple margin anatomy

Subareolar/nipple duct margin

Ductal tissue within nipple

Superficial retroareolar tissue

Tumor in subareolar/nipple duct margin requires nipple excision
Inferolateral incision: 12 cm from directly below nipple along periphery of breast

Areola flaps raised leaving subareolar-nipple duct bundle intact
Clamp grasps subareolar-nipple duct bundle immediately below dermis

Hooks retract under side of areola dermis, sharply divide tissue along clamp to avoid skin injury
Cut on specimen side of clamp to obtain subareolar-nipple duct margin

Subareolar-nipple duct margin
With this maneuver, nipple and areola skin are cleared of fat, parenchyma and duct tissue

Final nipple and areola margin free of fat, breast parenchyma and duct tissue
Patient Selection

- Acceptably low risk of nipple involvement
  - Prophylactic mastectomies, BRCA OK
  - No direct nipple involvement, negative imaging
  - >2 cm convention no longer necessary

- All but largest breasts eligible, ptosis OK

- Patient informed that positive margin will require nipple resection

- Patient aware that nipple sensation is lost

Tumor Involvement of the Nipple

316 consecutive total mastectomies Brachtel JCO 2009

- High grade DCIS most frequently involved nipple

- Few invasive carcinomas involved the nipple

- No prophylactic mastectomy nipples showed cancer
Surprises after 1300 nipple sparing mastectomies: Implications for patient selection

No nipple-areola recurrences to date

Nipple sparing increases options for single stage implant reconstruction for small-medium sized breasts

- Avascular dermal matrix, Vicryl mesh
- Single stage approach reduces morbidity and cost
Ptosis is corrected by nipple sparing mastectomy

- Nipple is uplifted by procedure
- Ptotic breasts excellent cosmetic result
- Laxity of skin in ptotic can make surgical exposure easier

Nipple sparing mastectomy corrects ptosis

Pre-op 6 weeks post-op
Bilateral mastectomies, inferolateral incision, single stage implant reconstructions

Pre-op vs. 2 months post-op single stage implants
Inframammary incisions give best cosmetic result

Early separation of breast from pec major helps exposure

Bilateral prophylactic nipple sparing mastectomies
BRCA mutation carrier - Pre-op

Single stage implant reconstruction 6 weeks post op
NSM is safe in BRCA mutation carriers

- 397 NSM in 201 BRCA mutation carriers
  - 125 BRCA1 (62%), 76 BRCA2 (38%)

- Incidental cancers
  - 150 pts prophylactic – 3% incidental cancers
  - 51 pts with cancer – 4% incidental cancers

- No new recurrent cancers in nipple/areola
  - 33 months mean f/u (range 1-76)

Prior radiation and post mastectomy radiation do not preclude nipple sparing

Patients with prior breast radiation can have nipple sparing mastectomy
  - Increased nipple loss – 4% vs. 1%
  - Higher rates of skin necrosis requiring revision
  - Slower healing, skin congestion
  - Old incisions can be ignored

Similar increase in complications with post mastectomy radiation

Tang SSO 2013
Kansal ASBS 2013
Eligibility for NSM may be safely expanded – Coopey Ann Surg Onc 2013

• Review of 645 consecutive NSM in 370 patients from June 2007-December 2012

• Each breast considered separately

• NSM from 2007-10 were compared to NSM from 2011-12
### Tumor Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean invasive tumor size</td>
<td>1.8 cm (0.01-6.2 cm)</td>
</tr>
<tr>
<td>Mean tumor-to-nipple distance</td>
<td>4.0 cm (0-10.7 cm)</td>
</tr>
<tr>
<td></td>
<td>25% were &lt; 2 cm</td>
</tr>
<tr>
<td>Positive lymph nodes</td>
<td>51 (14%)</td>
</tr>
<tr>
<td>Neoadjuvant chemo</td>
<td>27 (7%)</td>
</tr>
<tr>
<td>Prior radiation</td>
<td>48 (7%)</td>
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</tbody>
</table>

### Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median follow-up 22 months</td>
<td></td>
</tr>
<tr>
<td>Total nipple necrosis</td>
<td>11 (1.7%)</td>
</tr>
<tr>
<td>Positive nipple margin</td>
<td>24 (3.7%)</td>
</tr>
<tr>
<td>Local recurrence</td>
<td>4/156 (2.6%)</td>
</tr>
<tr>
<td>(among cancer patients with at least 2 yrs f/u)</td>
<td>No recurrences in nipple or areola</td>
</tr>
<tr>
<td>Cancer after prophylactic mastectomy</td>
<td>0</td>
</tr>
</tbody>
</table>
Comparison of Patients Undergoing NSM MGH 2007-10 vs 2011-12

<table>
<thead>
<tr>
<th></th>
<th>2007-2010</th>
<th>2011-2012</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Patients</td>
<td>93</td>
<td>277</td>
<td></td>
</tr>
<tr>
<td>Mean Age (yr) [range]</td>
<td>46 [27-78]</td>
<td>48 [23-71]</td>
<td>0.16</td>
</tr>
<tr>
<td>Mean BMI (kg/m²) [range]</td>
<td>22.9 [18.2-31.0]</td>
<td>24.4 [16.9-44.8]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Current Smoker (%)</td>
<td>3 (3.2)</td>
<td>15 (5.4)</td>
<td>0.39</td>
</tr>
<tr>
<td>Diabetes (%)</td>
<td>0 (0.0)</td>
<td>3 (1.1)</td>
<td>0.31</td>
</tr>
<tr>
<td>+ Lymph Node(s) (%)</td>
<td>6 (6.5)</td>
<td>45 (16.3)</td>
<td>0.016</td>
</tr>
<tr>
<td>Neoadjuvant Chemo (%)</td>
<td>4 (4.3)</td>
<td>23 (8.3)</td>
<td>0.28</td>
</tr>
<tr>
<td>Number of Breasts</td>
<td>170</td>
<td>475</td>
<td></td>
</tr>
<tr>
<td>Mean Breast Volume (cm³) [range]</td>
<td>366 [55-986]</td>
<td>519 [46-1706]</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Indication: Cancer (%)</td>
<td>62 (36.5)</td>
<td>253 (53.3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Prophylactic (%)</td>
<td>108 (63.5)</td>
<td>222 (46.7)</td>
<td></td>
</tr>
<tr>
<td>Invasive Tumor Size (cm) [range]</td>
<td>1.62 [0.05-6.0]</td>
<td>1.79 [0.01-6.2]</td>
<td>0.40</td>
</tr>
<tr>
<td>Prior Radiation (%)</td>
<td>12 (7.0)</td>
<td>36 (7.6)</td>
<td>0.82</td>
</tr>
<tr>
<td>Total Nipple Necrosis (%)</td>
<td>4 (2.4)</td>
<td>7 (1.5)</td>
<td>0.45</td>
</tr>
<tr>
<td>+ Subareolar/Nipple Margin (%)</td>
<td>11 (6.5)</td>
<td>13 (2.7)</td>
<td>0.027</td>
</tr>
</tbody>
</table>

Coopey Ann Surg Onc 2013

Expanding eligibility for NSM: Conclusions

- No increase in nipple loss due to ischemia
  - Despite expanded criteria including women with higher BMI and larger breasts

- Rates of positive subareolar/nipple margins have decreased
  - Even though NSM more frequently for cancer
  - Reflects improved patient selection
Nipple sparing mastectomy: Conclusions

• Oncologically safe for majority of breast cancer and prophylactic mastectomy patients
  – No nipple/areola recurrences in 1300 NSM since 2007 at MGH

• With experience, nipple ischemia/loss is rare

• Any reconstruction approach possible
  – Single stage implants ideal for many

• Superior cosmetic outcome