2016 SBI/ACR Breast Imaging Symposium

Imaging and Management of the Axilla

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Chief, UCSF Breast Imaging
April 10, 2016
Why devote a session to axillary management?

- Sentinel node?
- Biopsy the axilla?
- Clip the axilla?
- LN localization?
- Axillary lymph node dissection?
- US the axilla?
- Z11? 
- Z1071?
Surgical management of the axilla has evolved towards less invasive approaches in select patient populations. Communication between radiologists and other members of the patient care team is key to ensure appropriate use of imaging and biopsy in the axilla.
Lecture Outline

• Why change?
  – AXLD vs. SLN
  – Z11 Trial (Breast conservation patients)
  – Z1071 Trial (SLN in Neoadjuvant patients)

• What can we offer as breast imagers?
  – US, MRI evaluation of lymph nodes
  – LN localization
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Axillary Lymph Node Dissection (ALND)

• Once considered standard of care for early stage breast cancer treatment

• Earlier detection of breast cancer through screening → reduced incidence of nodal mets

• ALND may be overtreatment
  – ALND Morbidities: pain, lymphedema, infection, loss of sensation
Sentinel Lymph Node Biopsy (SNL)

- Introduced in 1990s
- Less invasive, less morbidity c/w ALND
- False negative rate ~10%
- Better results using combination of blue dye and radiocolloid injection
- replacement for ALND given reduced morbidity
Sentinel Lymph Node Biopsy (SNL)

- Sentinel node negative
  - No need for ALND per current NCCN guidelines
  - NSABP B-32 trial
- What about positive sentinel node?
  - ALND questioned as standard of care
  - With limited axillary disease

Is less, more? <= =>?
Lymphedema (Morbidity of Ax Surg)

Incidence of lymphedema after SLN is lower compared with ALND


http://varicoseveintreatmentnyc.com/lymphedema/
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ACOSOG Z011 Trial

- Randomized Controlled Trial of ALND vs. no ALND after positive sentinel node biopsy in BCT patients.
- No survival difference between groups
- Patients had limited axillary mets ($\leq 2$ positive sentinel nodes)
- Patients underwent lumpectomy with negative margins, whole breast XRT, & adjuvant therapy

Giuliano, et al. JAMA 2011 Feb 9;305(6):569-75
### ACOSOG Z0011 Trial

#### Survival results at 5 years

<table>
<thead>
<tr>
<th></th>
<th>ALND</th>
<th>SLN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>82.2%</td>
<td>83.9%</td>
</tr>
<tr>
<td>Disease free</td>
<td>91.8%</td>
<td>92.5%</td>
</tr>
</tbody>
</table>

*Courtesy of Dr. Jessica Hayward UCSF*
ACOSOG Z0011 Trial

Survival results at 5 years

No difference in overall and disease-free survival between study groups

Overall 82.2% vs. 83.9%
Disease free 91.8% vs. 92.5%

Courtesy of Dr. Jessica Hayward UCSF

JAMA 2011 Feb 9;305(6):569-75
Z11—practice changing?

• Controversial study, many large institutions refused to participate
  – Early closure due to poor accrual (47% enrolled of targeted 1900 patients)

Haffty, Journal of Clinical Oncology 2011, 29(34), 4479-4481
Z11—practice changing?

- Critics argue 5-year follow up too short
- Z11 population enriched for low burden of axillary disease
- *Radiation fields likely treated low axillary nodes*

Haffty, Journal of Clinical Oncology 2011, 29(34), 4479-4481
Z11—practice changing?

- Community practices report shift to fewer ALNDs and more intraoperative SLN evaluation
  - post Z11, significant reduction in ALND for patients meeting Z11 criteria (71% pre Z11, 7% post Z11)
  - Extrapolated criteria for total mastectomy patients (82% to 36%) ??safety of this approach

ALND may be avoided in patients with ALL the following

- Lumpectomy
- T1 or T2 tumor
- $\leq 2$ positive nodes
- *Whole breast radiation*
- Adjuvant therapy

*Courtesy: Dr. Jessica Hayward UCSF  Am. Soc. Surg. Position Statement*
ACSOG Z0011 Trial: Summary

Results DO NOT apply to patients with any of the following

- Mastectomy
- T3 or T4 tumor
- 3+ positive nodes
- Partial breast radiation
- Neoadjuvant chemotherapy

Am. Soc. Surg. Position Statement

Courtesy: Dr. Jessica Hayward UCSF
So do we still perform axillary US and US bx in early stage breast cancer? Yes.

It depends on surgeon preference, patient preference (BCT vs. mastectomy, type of XRT)

UCSF: surgeons still want imaging and bx if abnl
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ACOSOG Z1071

- Observational study to determine false negative rate of SLN biopsy in setting of neoadjuvant chemotherapy and positive Ax LN based on percutaneous biopsy

- If false negative rate 10% or lower (i.e. same as rate for node negative patients) then may be possible to avoid ALND

ACOSOG Z1071

- Prospective multi-institutional trial
  - 136 institutions
  - July 2009-June 2011
  - 756 patients with T0-4; N1-2; M0 tumors
  - 649 underwent chemotherapy & both SLN and ALND
  - 525 had 2 or more SLN removed

ACOSOG Z1071 Trial

Patients with cN1* disease at presentation and residual nodal disease in ALND after neoadjuvant chemotherapy

<table>
<thead>
<tr>
<th>Number of sentinel nodes removed</th>
<th>False negatives (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>21.1 (19/90)</td>
</tr>
<tr>
<td>3+</td>
<td>9.1 (20/220)</td>
</tr>
<tr>
<td>Overall</td>
<td>12.6 (39/310)</td>
</tr>
</tbody>
</table>

cN1: + mobile axillary nodes


cN2: + matted ax nodes
ACOSOG Z1071

- Results: **12.6%** overall false negative rate for SLN biopsy (*not* below 10% threshold)

But close……

ACOSOG Z1071

• Subset analysis of main trial
• 141 patients with confirmed clip in Ax LN; cN1 disease and 2+ SLN resected
• 107 w/ clip in SLN specimen: FNR 6.8%
• 34 cases w/ clip in ALND specimen, FNR of SLN: 19.%

Clip placement at diagnosis of node-positive disease with removal of clipped node during SLN surgery reduces FNR.

Authors suggest that clip placement in node be considered when conducting SLN surgery.

Do you place clips in axillary nodes after biopsy?

a. Yes

b. No
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The Breast Imager’s Approach to Nonmammary Masses at Breast and Axillary US: Imaging Technique, Clues to Origin, and Management

Matthew C. Oliff, MD
Robyn L. Birdwell, MD
Sumit Raza, MD
Catherine S. Giess, MD

RadioGraphics 2016; 36:7-18
Published online 10.1148/rg.2016150029
Content Codes: [BR MD US]

Ultrasonography (US) of the breast and axilla is primarily used to evaluate a symptomatic patient or to further investigate findings identified with other imaging modalities. Breast imagers are generally familiar with US evaluation of level I, II, and III axillary lymph nodes in the diagnosis and staging of breast cancer. However, the axilla contains nonlymphatic tissue as well, including muscle, fat, and vascular and neurologic structures, and anatomically the breast lies on the chest wall. Therefore, lesions of nonmammary and non–lymph node origin in the axilla or chest wall are not infrequently encountered during US evaluation of the breast or axilla. In fact, such lesions may be the...
Teaches anatomy, scan technique (with downloadable video)

Video demonstrating scanning technique:

Figure from Oliff, et al.

Axillary Staging of Breast Cancer: What the Radiologist Should Know

Jacob S. Ecanow, MD • Hiroyuki Abe, MD • Gillian M. Newstead, MD • David B. Ecanow, MD • Jan M. Jeske, MD

Identifying the presence of axillary node and internal mammary node metastases in patients with invasive breast cancer is critical for determining prognosis and for deciding on appropriate treatment. Sentinel lymph node biopsy (SLNB) is the definitive method to exclude axillary metastases. Patients with positive SLNB results generally undergo axillary lymph node dissection (ALND). The benefit of preoperative identification of axillary metastases is that it allows the surgeon to proceed directly to ALND and to avoidunnecessary SLNB and the need for...
Abnormal LN at US (focal bulge)

Pre-bx image

FNA biopsy
Axillary Nodes on Breast MRI

- Bilateral axillae are generally included in the FOV of routine breast MRI
  - R-L phase artifact may obscure on some sequences
- Axillary Lymphadenopathy
  - Morphologically enlarged, rounded, asymmetry with contralateral side
Axillary Lymphadenopathy (Level 1, lateral to pect minor)
Axillary Lymphadenopathy
(Level 3, medial to pect minor)
Axillary dissection vs. sentinel node

Lumpectomy
- ≤2+ SN stop in select patients (Z0011 trial)
- 3+ SN ALND
- 1+ SN ALND

Mastectomy
- <1 SN stop
- 1+ SN ALND

Neoadjuvant
- <1 SN stop
- 1+ SN ALND

Evolving (Z1071)

Courtesy: Dr. Jessica Hayward UCSF
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  – LN clip, localization
Targeted Axillary Dissection after NAC


Abigail S. Caudle, Wei T. Yang, Savitri Krishnamurthy, Elizabeth A. Mittendorf, Dalliah M. Black, Michael Z. Gilcrease, Isabelle Bedrosian, Brian P. Hobbs, Sarah M. DeSnyder, Rosa F. Hwang, Beatriz E. Adrada, Simona F. Shaitelman, Mariana Chavez-MacGregor, Benjamin D. Smith, Rosalind P. Candelaria, Gildy V. Babiera, Basak E. Dogan, Lumarie Santiago, Kelly K. Hunt, and Henry M. Kuerer

Targeted Axillary Dissection after NAC

- Localization of the clipped node for targeted axillary dissection reduced the false negative rate of SLN bx in setting of neoadjuvant chemotherapy.

- *Does this mean we should all be clipping and localizing axillary LNs for surgery?*

Regardless if we agree on whether to localize lymph nodes....
Localization of Axillary Nodes

- Wire localization (US, CT, MR)
- Radioactive Seed localization
- Tattoo Inking
- SPIO (superparamagnetic iron oxide)
- Magnetic (SPIO) clip
- Reflector clip
- Probably more in the future....
Unintentional axillary wire placement

Wire presumed to have migrated during imaging after placement under US
Unintentional axillary wire placement

Intended target: far upper outer breast mass and clip
US-guided wire localization of Ax LN

Improving the Accuracy of Axillary Lymph Node Surgery in Breast Cancer with Ultrasound-Guided Wire Localization of Biopsy Proven Metastatic Lymph Nodes

Donna Plecha, MD¹, Shiyu Bai, BS², Helen Patterson³, Cheryl Thompson, PhD⁴, and Robert Shenk, MD⁵

¹Department of Radiology, University Hospitals Case Medical Center, Cleveland; ²Case Western University School of Medicine, Cleveland; ³Amherst College, Amherst; ⁴Case Western Reserve University, Cleveland; ⁵Department of Surgery, University Hospitals Case Medical Center, Cleveland
The iALN with a marker was identified. A fiducial BB was placed on the skin. A 20-gauge needle was inserted. Wire was deployed within iALN. The needle tip was placed within iALN. The needle was repositioned and reimaged.

Courtesy Dr. Debra Ikeda, Stanford University
Initial Results with Preoperative Tattooing of Biopsied Axillary Lymph Nodes and Correlation to Sentinel Lymph Nodes in Breast Cancer Patients

Nicole Choy, Jafi Lipson, Catherine Porter, Michael Ozawa, Anne Kieryn, Sunita Pal, Jennifer Kao, Long Trinh, Amanda Wheeler and 4 more

Tattoo Marking of Axillary Lymph Node

Inject tattoo ink into anterior portion of LN

FNA Biopsy

Tattoo LN with Ink

Courtesy Dr. Jafi Lipson, Dr. Debra Ikeda, Stanford University
SPIO for SNL

Stained LN

- SPIO injected similar to blue dye injection
- Iron deposits in sentinel nodes
- Detect in axilla with magnetometer
- Stains dark color

Image courtesy of Mathew Stephens <mstephens@endomag.com>

J Surg Oncol. 2016 Jan 12
SPIO-MRI to predict malignant lymph nodes

Image pre-injection and ~18-48h after SPIO tracer injection (2 visits).

Seq: T1, T2, T2* without gadolinium

CT  MR-pre SPIO  Post SPIO  Water Excitation

CT-lymphography  MRI, pre-SPIO  MRI, post-SPIO  MRI, water excitation  Histology

Normal Nodes turn “black” (SPIO uptake)

Metastatic Nodes stay “white” (no SPIO uptake)

Axillary Management is Evolving

- Radiology continues to have an important role in axillary management
- Need to work closely with your surgeons, oncologists, radiation oncologists
- Factor in patient’s wishes
- No clear cut answer, different surgeons may take different approaches
Surgical management of the axilla has evolved towards less invasive approaches in select patient populations. Communication between radiologists and other members of the patient care team is key to ensure appropriate use of imaging and biopsy in the axilla.
Thank you for your attention

bonnie.joe@ucsf.edu

Pharoah Cuttlefish