Understanding your pathology report:
Lessons in Radiology-Pathology Correlation

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Merging of fields?

Integrating Radiology, Pathology Would Improve Diagnostics, Aid Patients

Integrating pathology and radiology disciplines: an emerging opportunity?

James Sorace, Denise R. Aberle, Dena Elimam, Silvana Lawvere, Ossama Tawfik, and W. Dean Wallace

Sorace et al. BMC Medicine 2012, 10:100
http://www.biomedcentral.com/1741-7015/10/100
15 days of training on 24 images/group (2 sets) with rewards
→ 50% accuracy Day 1
→ 85% at Day 13-15

Tested on novel images mixed with training set
→ 87% accuracy on originals
→ 85% accuracy on novel!!

http://journals.plos.org/plosone/article?id=info:doi/10.1371/journal.pone.0141357
“Flock-Sourcing Diagnoses”

- “Flock-sourcing” accuracy reached 99%
- Value of second opinions!

**Fig 9. Flock sourcing.** A “flock-sourcing” score was calculated by summing the responses of individual birds as described in the text. Pooling the birds’ decisions led to significantly better discrimination than that achieved by individual pigeons. The dotted line represents no discrimination between benign and malignant exemplars.

doi:10.1371/journal.pone.0141357.g009
Radiology-Pathology Correlation: Working Together
Goals and Objectives

• Understand how pathologic examination of tissue occurs
• Radiology-pathology correlations
• Grey zones for pathology
• Recognizing red flags
• Communication strategies
What happens to a breast tissue sample in pathology?

1. Tissue Sampled
2. Tissue Examination, Fixation and Selection
3. Paraffin Block
4. Unstained Sections Cut
5. Make Glass Slide & Stain
6. Examine Under Microscope

Histology lab techs
Limitations of Pathology Sampling

• Every block contains tissue 0.4 cm or thinner (nickel thickness)
• Every slide is about a 5 micron cut off the top of the tissue block
  – Small sample
  – Can have many slides cut from one block
• Re-facing into a block for additional levels or extra stains “wastes” some tissue sections in order to get a complete section
• Takes time...........
Example Case

• 65 year old woman with 3 mm of pleomorphic calcifications on mammography with the following on core biopsy:
Where are the calcs?

• When no calcifications are present on initial slides:
  – Levels (look at tissue deeper in block)
  – X-ray of the tissue blocks

• When STILL no calcifications identified:
  – May have been in “wasted” tissue sections when facing into the block (was likely very focal)
  – May have been missed (check specimen xray)
Does it correlate?

Did you sample the target and what was it?
When the target is a mass

- **Common correlates:**
  - Invasive cancer
  - Mass-forming DCIS
  - Fibroepithelial lesion
  - Clusters of cysts/apocrine metaplasia
  - Papillary lesions
  - Fat necrosis/biopsy site change

- **Not always clear if correlates:**
  - “Benign breast tissue”
  - Fibrocystic change
  - Fibroproliferative changes (UDH, sclerosing adenosis, etc)
  - Fibrotic breast tissue
  - Focal incidental risk lesions (ex. ALH, ADH)
Does it correlate?

- **Target:**
  - 5 mm mass on ultrasound

- **Pathology:**
  - “Fibro-proliferative changes”

Need more information!
Does it correlate?

• Target:
  – 5 mm mass on ultrasound

• Pathology:
  – “Nodular area of sclerosing adenosis”

✔ Correlates
Does it correlate?

- **Target:**
  - 1.4 cm mass on ultrasound

- **Pathology:**
  - “Atypical lobular hyperplasia”

Need more information!

*Does ALH explain the mass or is it incidental?*
Does it correlate?

- **Target:**
  - 1.4 cm mass on ultrasound

- **Pathology:**
  - “Focal atypical lobular hyperplasia, see comment”

Comment: The core biopsy contains focal ALH involving a single terminal-duct-lobular unit. The background breast tissue contains non-proliferative variably fibrous breast tissue. There is no definite histologic correlate to a 1.4 cm mass.

**Does NOT explain the mass!**
Incidental risk lesion findings

- Don’t explain the target (calcs, mass)
- Debate about whether require excision
- Pathologist should describe targeted lesion separately
- Common terms to describe:
  - “incidental,” “microscopic,” “focal”
Does it correlate?

• Target:
  – 0.4 cm mass on ultrasound

• Pathology:
  – “Breast tissue with focal areas of fibrosis”
What is the targeted lesion?

- Challenging for pathologist to determine where lesion is when a variant of “normal”
  - Fibrosis
  - Proliferative epithelial changes
  - Metaplasias
Correlation of Non-Mass Enhancement on MRI: When the findings are not malignant

• Common benign pathology that can explain NME
  – Benign proliferative changes (UDH, sclerosing adenosis, adenosis)
  – Apocrine metaplasia
  – Pseudoangiomatous stromal hyperplasia (PASH)
  – Pseudolactational change
  – Bland endothelial vascular lesions
  – Biopsy site changes/prior surgical changes

• Common high-risk pathology for NME
  – Lobular in situ neoplasia (ALH/LCIS)
  – Atypical ductal hyperplasia

What are you willing to accept for the pathology?
Does it correlate?

- **Target:** NME
- **Pathology:** Papillary cystic apocrine metaplasia
Pseudo-angiomatous stromal hyperplasia: PASH

- Benign variant of normal stroma
- Not truly vascular
- Vascular lesions and PASH can explain NME
Does it correlate?

• Target:
  – 1.2 cm architectural distortion on mammography

• Pathology:
  – “Ducts with calcifications and surrounding sclerosis”
What is a radial scar?

- Stellate configuration of ducts around a central “nidus”
- Nidus contains ducts embedded in sclerotic and elastotic stroma
- Can mimic invasion on both imaging and pathology
Pathology terminology suggestive of radial scar

- “Complex sclerosing lesion”
- “Sclerosing duct lesion”
- “Ducts with surrounding elastosis and fibrosis”
- Often myoepithelial markers used by immunohistochemistry to confirm not invasion
  - SMMS, calponin, p63
Other sclerotic lesions

- Papilloma with sclerosis
- Sclerosing adenosis
- Complex fibroadenoma

Can be challenging to differentiate on core biopsy!
Diagnostic challenges for the pathologist: Grey Zones

- Sclerotic lesions
- Subtle forms of invasion (extensive DCIS, invasive lobular carcinoma, nested invasion)
- Solid lobule-based lesions
  - DCIS vs ALH/LCIS vs benign
- Papillary lesions
  - Atypical Ductal Hyperplasia
  - Flat Epithelial Atypia
  - Fibroepithelial lesions

*Sampling issues on core

Can use IHC stains to help with diagnosis

IHC not typically helpful
Diagnostic challenges for the pathologist: Grey Zones

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*Sampling issues on core
Agreement with consensus diagnosis is very high for invasive cancer!
Agreement with consensus diagnosis is low for atypia
Higher agreement for practices with higher volume breast cases, academic setting
• 240 test set cases with expert reference consensus diagnoses
• 115 participating pathologists that interpret breast cases in practice
  – Each reviewed 60 test set cases
  – Single glass slide/case (Digital WSI cases not included in the currently published analysis)
• Cases randomly selected by original diagnosis (not selected based on the level of challenge of the case)
• Case mix weighted for more ADH and DCIS than typical of practice
• An attempt to look at degree of diagnostic variability in the pathology community

Breast Biopsies Leave Room for Doubt, Study Finds

By DENISE GRADY  MARCH 17, 2015

Study: Biopsy Specialists Frequently Misdiagnose Breast Tissue
By Lindsey Tanner, AP Medical Writer
March 17, 2015 11:34 AM

Pathologists Interpreting Breast Biopsy Highly Accurate
March 18, 2015
• Overall diagnostic agreement on atypia = 48%
• Agreement by case ranged from 30% to 70%

Agreement on ADH is highly case-dependent

• Applying B-Path results to BCSC breast biopsy diagnosis frequency
• Overall 92.3% of diagnoses would be verified by consensus expert diagnosis
• Main issue with ADH = “over-interpretation” of “benign” findings
Definition of ADH

• Some but not all of the features of LG DCIS:
  – Cytology: Low grade monotonous cells
  – Architecture: Bridging, polarized spaces, micropapillae, early cribriform growth

• Size criteria:
  – Developed for use in excisions only
  – Two duct spaces or 2.0 mm (these can be quite different!)
Monotonous Cytology? YES
Neoplastic architecture? YES
Extent? < 2 mm but > 2 duct spaces...
Uniform, well-developed architecture? Partial involvement

Recent test case at USCAP course:
55% of respondents called ADH
45% called DCIS
Why do we disagree?

**Understanding diagnostic variability in breast pathology: lessons learned from an expert consensus review panel**

Kimberly H Allison, Lisa M Reisch, Patricia A Carney, Donald L Weaver, Stuart J Schnitt, Frances P O’Malley, Berta M Geller & Joann G Elmore

<table>
<thead>
<tr>
<th>#1</th>
<th>Pathologist-related</th>
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<td>Professional differences of opinion on features meeting diagnostic criteria</td>
<td>Discussion focused on subtle differences of professional opinion about whether the features present met the criteria for a specific diagnosis</td>
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<th>#2</th>
<th>Not noting a focal diagnostic finding</th>
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<td>Pathologist verbally acknowledged not noting the diagnostic area of the slide (all of these were focal findings)</td>
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<th>Different diagnostic philosophy (clinical impact versus morphology)</th>
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<td>Discussion focused on differences in taking into account the potential clinical relevance of a diagnosis versus utilizing strictly morphological features</td>
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<th>Different diagnostic criteria</th>
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<td>Discussion focused on pathologists’ use of different diagnostic criteria for a specific diagnosis in a given case</td>
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<th>Different diagnostic features noted</th>
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<td>Discussion focused on disagreement about the specific morphological features present</td>
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*Histopathology 2014, 65, 240–251. DOI: 10.1111/his.12387*
Forced to Put a Biologic Spectrum into Diagnostic Boxes

UDH/CCH

ADH

LG DCIS

Puts the Pathologist in a box!!
UDH

UDH with no definite atypia

Minimal extent ADH

ADH

ADH borderline with LG DCIS

Lesion with mixed areas

Minimal extent LG DCIS

LG DCIS

< 2 mm

2-3 mm

Reality is more complex!
Predictable Disagreement!

- Borderline features with low grade DCIS
- Focal finding
- Solid/subtle or non-cribriform architecture
- Close to 2mm threshold
- Subtle cytologic monotony
Of participants reporting no second opinion policy for ADH:
• 83.9% obtained second opinions in at least some cases
• 28.0% in all cases

Consensus is sought on ADH in practice!
Radiology-Pathology Correlation for Breast Surgical Cases

Goal of gross examination: Targeted tissue sampling of expected lesions
Lumpectomy specimens

Wires mostly help surgeons (removed by pathology to section tissue). Clips and calcs are not always visible.
Mastectomy Sampling:

Pathology needs clues to orient where findings are and ensure appropriate sampling.
Radiograph of sliced lumpectomy marked with where tissue samples taken
How to sample?

With no radiology:
- Biopsy site in fatty tissue
- Size: Cancer in 5 slices, each 0.4 cm thick = 2.0 cm

Prior pathology:
- Invasive lobular carcinoma
- Sample more extensively

Imaging of 5.5 cm of NME:
- Submit entire specimen
- Size: 14 slices x 0.4 cm = 5.6 cm
Cases where more sampling is necessary: **Extent not apparent grossly**

- DCIS →
  - r/o presence and size of smaller foci of invasion
- Lobular carcinoma
- Post-chemotherapy tumor bed
- Large biopsy site/cavity/hematoma
- Multiple lesions → sampling in between
- MRI findings
Need to know location and original span of invasive cancer on imaging

Post-neoadjuvant: Tumor bed can be very hard for the pathologist to identify

Map of Residual Disease after Neoadjuvant Chemotherapy

Sample at least an entire cross-section/cm over the span of original pre-treatment cancer and create a map of tissue submitted in order to report:
- Span of residual invasion in 2 dimensions: 5.5 cm X 3.5 cm
- Size of largest single focus: 2.5 cm
- Overall cellularity: 40%

Original span of cancer pre-chemotherapy=5.5 cm x 3.5 cm
(Often correlates with gross tumor bed/scar)
Keys to Effective Gross Exam: Targeted Tissue Sampling

• WHAT ARE WE EXPECTING?
  • Based on provided information and medical record

• #1: Size and number of lesions present?
• Was the patient pre-treated with chemotherapy?
• Expect a previous biopsy site or clip?
• Can use Breast Grossing Templates to ensure information is looked up
Gross Template to Ensure Clinical Correlation

**Targeted lesions expected:**

- Total number of lesions expected:
- Is this post-neoadjuvant chemotherapy?:

For each expected lesion determine the following:

**Lesion 1:**

Label of lesion used in imaging reports: [ ex. L1, R1]

**Targeted imaging finding:** [mass, asymmetry, calcifications, MRI enhancement]

- Expected location: [relative location in a lumpectomy, distance and location relative to other lesions, in a mastectomy the quadrant, o’clock and distance from nipple or margins,]

- Expected size/extent:

- Expected clip/biopsy: [@prior biopsy documented with clip placement/prior biopsy documented without clip placement/no prior biopsy or clip placement documented]
Communication Strategies

• Case by case contact (in person, phone, email)
• Regularly scheduled conferences (in person or tele-presence)
• Communication from the OR/imaging suite (requisitions with key information for pathology)
• Standardized radiology and pathology reporting
• Pathology and radiology at different sites
• Weekly web-conferencing on cases with non-malignant diagnoses
• Decision-making affected in 34.4% of 122 cases (22% minor impact and 13.1% major impact)
1387 case reviewed at weekly confr

Before conference: 2.4% considered discordant, 94.7% concordant

After conference: 5.3% (N=74) cases changed concordance status as follows:

- 29.7% discordant → concordant (avoided excision)
- 31.1% concordant → discordant (on excision 13% = cancer)
- 39.2% stayed concordant but change in management decision after review

Reasons: unclear if target sampled (different imaging technique), incidental findings
Benefits of discussion/conference

• Visual confirmation/correlation
• Consensus building
• Second opinions from colleagues
• Familiarity with terminology used in reports
Clinicians misunderstood pathology report details 30% of the time

• Worse with newer formats...importance of transition time, piloting and communicating

• Importance of Readable Reports
A Web-based System for Integrating and Correlating Radiology and Pathology Findings During Cancer Diagnosis

Arnold CW, et al
How to help your pathologist?

• Most pathologists are not specialists in breast pathology and deal with many specimen types
• May not have access to imaging records
• May be at remote locations
• Tell us what was targeted and ask us to correlate!
  – Clip it, describe size, location, relationship to other lesions or landmarks for us
• Communicate for better patient care!