Improving Pediatric Breast Ultrasound Reporting and Recommendations: A Quality Improvement Initiative

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Pediatric Breast Imaging

- Breast masses are uncommon in the pediatric population
  - Frequently cause considerable concern for the patient and their parents

- Ultrasound (US) is the preferred imaging modality
  - Lack of ionizing radiation
  - Adequate tissue characterization
  - Easy availability

- Mammography is not advised in children
  - Low incidence of malignancy
  - Risk of radiation to the immature glandular tissues
  - Poor lesion conspicuity in dense fibroglandular breasts

Pediatric Breast Ultrasound

- At CHLA, pediatric breast ultrasound is reviewed by pediatric radiologists

- Recommendations are generally based on individual experience and practice
  - No formal guidelines, consensus or recommendations for management of imaging findings on pediatric breast ultrasound

- Inconsistent recommendations can confuse clinicians
  - May lead to additional, unnecessary imaging, procedures, and/or surgery
Current Practices

- Breast Imaging-Reporting and Data System (BI-RADS) is a widely used risk assessment and quality assurance tool
  - Mammography, ultrasound or MRI
  - Developed for adult women

What are the current recommendations for pediatric breast ultrasound?

Goals

- To find or establish literature based guidelines for recommendations based on common pediatric breast US findings
  - Can BI-RADS be used in the pediatric population?
- To consistently offer standardized recommendations for common pediatric breast US findings
  - What are the current recommendations for the pediatric population?
- To stop routinely encouraging further imaging
  - Recommend further imaging only when clearly indicated
  - Avoid routine recommendations such as “Follow up with dedicated imaging at Women’s Imaging Center” or “Consider breast MRI”
Quality Improvement: Plan-Do-Study-Act Model

**PLAN**
- Literature Search
- Retrospective Chart Review

**DO**
- Standards Development
- Implementation

**ACT**
- Solicit Feedback
- Revise Standards

**STUDY**
- Retrospective Chart Review

Radiological Society of North America
December 2016
Literature Search

- To build evidence for our initiative, we performed a search of the current scientific literature to establish best practices

- Specifically, we searched the literature for:
  - Appropriateness of applying BI-RADS to the pediatric population
  - Current recommendations for ultrasound findings specific to the pediatric population

- Pubmed database was queried with the following search terms on 7/21/15
  - Pediatric, breast ultrasound, BI-RADS
Koning, et al

• Retrospective review of all surgically excised breast masses* at a single tertiary care pediatric hospital (UCSD) between July 2010 and November 2013

• Patients** with preoperative breast ultrasound and a BI-RADS-US classification were selected.
  – Clinical notes, laboratory data, and surgical pathology reviewed via EMR

• Surgical pathology reports were used for correlation of BI-RADS classification

* Patients operated on for gynecomastia or breast abscess were excluded
** Postmenarchal females age 15-19

Study Population

119 palpable masses
81 masses imaged preoperatively
59 ultrasound reports available
51 masses assigned BI-RADS classification
Surgical pathology available for all 51 masses
No masses were assigned BI-RADS category 5 or 6

All masses were found to be benign on pathology
Conclusions

• BI-RADS was developed to assess risk of malignancy in adult patients and to communicate the risk of malignancy
  – It has been increasingly applied to US performed on pediatric patients and adolescents

• Authors noted that management of a BI-RADS 4 classification is significantly different from a BI-RADS 3 classification
  – Likely resulting in biopsy of masses that could have been managed with observation

• Concluded that BI-RADS classification overstates the risk of malignancy in the pediatric and adolescent population

Pediatric Breast Ultrasound Recommendations

Current recommendations for ultrasound findings specific to the pediatric population from Pediatric Radiology and European Journal of Radiology
Table 2: Summary of appropriate differential diagnosis and clinical recommendations for diagnosis of pediatric brain masses

<table>
<thead>
<tr>
<th>Clinical feature</th>
<th>Differential diagnosis</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonate or young child</td>
<td></td>
<td>Do not biopsy; clinical follow-up is sufficient</td>
</tr>
<tr>
<td>Simple cystic mass</td>
<td></td>
<td>Radiologic follow-up is necessary</td>
</tr>
<tr>
<td>Sinus</td>
<td></td>
<td>Otitis media, skull fracture, or orbital pseudotumor</td>
</tr>
<tr>
<td>Septum</td>
<td></td>
<td>Septum, arachnoid cyst, or dermoid cyst</td>
</tr>
<tr>
<td>Simple cystic mass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complex cystic mass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abscesses</td>
<td></td>
<td>Augmentation, consider follow-up US</td>
</tr>
<tr>
<td>Intracerebral abscesses</td>
<td></td>
<td>Augmentation, consider follow-up US</td>
</tr>
<tr>
<td>Meningoencephalocele</td>
<td></td>
<td>Augmentation, consider follow-up US</td>
</tr>
<tr>
<td>Ventriculomegaly</td>
<td></td>
<td>Augmentation, consider follow-up US</td>
</tr>
<tr>
<td>Intracranial hemorrhage</td>
<td></td>
<td>Augmentation, consider follow-up US</td>
</tr>
<tr>
<td>Post-traumatic intracranial hematoma</td>
<td></td>
<td>Augmentation, consider follow-up US</td>
</tr>
<tr>
<td>Metastatic disease</td>
<td></td>
<td>Augmentation, consider follow-up US</td>
</tr>
<tr>
<td>Primary intracranial neoplasm</td>
<td></td>
<td>Augmentation, consider follow-up US</td>
</tr>
<tr>
<td>Hypothalamic hamartoma</td>
<td></td>
<td>Augmentation, consider follow-up US</td>
</tr>
<tr>
<td>Intracranial mass effect</td>
<td></td>
<td>Augmentation, consider follow-up US</td>
</tr>
<tr>
<td>Radiologic follow-up</td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

Fig. 21: Flow to approach brain masses in children and adolescents - a diagnostic and management algorithm.
Quality Improvement Project: Plan

**PLAN**
- Literature Search
- Retrospective Chart Review

**DO**

**ACT**

**STUDY**

Pathologic Correlation

- We reviewed all breast ultrasounds performed at CHLA from 2013-2015
- Nine breast masses with pre-operative ultrasound imaging were surgically excised from 2013-2015

<table>
<thead>
<tr>
<th>Pathology</th>
<th>No. of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juvenile fibroadenoma</td>
<td>6</td>
</tr>
<tr>
<td>Phyllodes</td>
<td>1</td>
</tr>
<tr>
<td>Tubular adenoma</td>
<td>1</td>
</tr>
<tr>
<td>Gynecomastia</td>
<td>1</td>
</tr>
</tbody>
</table>

Benign pathology was consistent with that published in the literature (Koning, et al)
Quality Improvement: Do

PLAN

DO

ACT

STUDY

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Development of Standards

• Recommendations from the literature were synthesized into a chart
  – Organized by age and common ultrasound findings

• Recommendations underwent interdisciplinary review, with subsequent revision to reflect expert feedback
  – Board certified radiologist with fellowship training in Women’s Imaging
  – Board certified surgeon with fellowship training in Pediatric Surgery

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Standard Recommendations

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Imaging</th>
<th>DX</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palpable lump</td>
<td>Ultrasound</td>
<td>Biopsy</td>
<td>Surgical consultation</td>
</tr>
<tr>
<td>Palpable lump, nonpalpable lump</td>
<td>Ultrasound</td>
<td>MRI</td>
<td>Surgical consultation</td>
</tr>
<tr>
<td>Palpable lump, nonpalpable lump</td>
<td>Ultrasound</td>
<td>MRD</td>
<td>Surgical consultation</td>
</tr>
<tr>
<td>Palpable lump, nonpalpable lump</td>
<td>Ultrasound</td>
<td>UE</td>
<td>Surgical consultation</td>
</tr>
</tbody>
</table>

Literature based, standardized recommendations were developed for common ultrasound imaging findings at CHLA

Quality Improvement: Do

- PLAN
  - Literature Search
  - Retrospective Chart Review
- DO
  - Standards Development
  - Implementation
- ACT
- STUDY
Standards Implementation

• Standardized recommendations were implemented January 11, 2015
  – Literature review results and standardized recommendations were presented to the radiology staff at a department-wide journal club
  – Feedback on the recommendations was solicited

• The standardized recommendations were electronically disseminated to the radiology staff for future reference

• Periodic feedback from the radiology staff was solicited at 3 month intervals

Quality Improvement Project

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ACT

STUDY
- Retrospective Chart Review
Breast Ultrasound Recommendations: Pre-intervention

- Retrospective analysis of the recommendations provided on the 76 diagnostic breast ultrasounds performed from 2013-2015
  - 9 examinations were discarded, as the standard recommendations were not applicable to the ultrasound findings

- Standard recommendations were compared to the recommendations provided on the remaining 67 pre-intervention ultrasounds
  - 35 (52%) of the examinations were found to have recommendations consistent with developed standard recommendations

Breast Ultrasound Recommendations: Post-Intervention

- 57 ultrasounds performed from 1/11/2016-9/11/2016
  - 3 examinations were discarded, because the standard recommendations were not applicable to the ultrasound findings

- Standard recommendations was applied to the remaining 54 post-intervention ultrasounds
  - 46 examinations (85%) had recommendations consistent with the standard recommendations
Following intervention, the number of recommendations consistent with the literature-based standard recommendations increased from 52% to 85%.

Quality Improvement Project

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- **DO**
  - Standards Development and Implementation

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  - Solicit Feedback
  - Revise Standards

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Future Directions

• Ongoing chart review
• Solicit practice feedback
• Further refine algorithm

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References


• Lee M, Soltanian HT. Breast fibroadenomas in adolescents: current perspectives. Adolesc Health Med Ther. 2015 Sep 2;6:159-63