

Improving Pediatric Breast Ultrasound Reporting and Recommendations: A Case Study in Clinical Practice Management

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EXECUTIVE SUMMARY

- To date, there are no consistent recommendations for managing diagnostic pediatric breast ultrasound imaging findings like there are for adults.
- In order to help develop formal guidelines for diagnostic pediatric breast ultrasounds, we devised standardized recommendations based on results of literature search and multi-disciplinary review from staff and faculty. Upon approval, we established the recommendations as department guidelines and implemented them in the Department of Radiology at Children's Hospital Los Angeles.
- Pre- and post-implementation evaluations revealed an improvement in the consistency of recommendations on diagnostic pediatric breast ultrasounds.

Background

Since inception in 1901, Children's Hospital Los Angeles (CHLA) has become one of the most respected academic medical centers in the US and a leader in treating children with medically complex diseases and injuries. As a standalone 495-bed non-profit institution, we have more than 528,000 patient visits annually, with patients coming from local and international locations. Our service area spans eight local counties including Los Angeles, Kern, Orange, Riverside, Santa Barbara, San Bernardino, San Luis Obispo, and Ventura. Our mission is to create hope and build healthier futures. We accomplish this by providing high-quality clinical care to the sickest children; conducting novel biomedical research on complex and/or life-threatening diseases; and training the next generation of leading pediatric physicians.

The Department of Radiology at CHLA provides the full spectrum of imaging services to children and young adults. Employing leading-edge imaging technology, our physicians perform over 130,000 examinations yearly. In addition to treating our young patients, our physicians work closely with imaging scientists to develop and test new potential

imaging options in order to improve diagnosis and treatment methods and advance imaging techniques.

In regards to pediatric breast imaging, there are no formal guidelines, consensus, or recommendations for management of imaging findings, specifically diagnostic pediatric breast ultrasound, like there are in the adult community. Many recommendations at our academic pediatric institution made by our board certified pediatric radiologists were previously made by individual experience rather than evidence based literature or a standard system of reporting. This led to confusion for our referring clinicians as well as unnecessary further imaging, procedures, or surgeries. Our goal was thus to improve the appropriateness and consistency of recommendations given for common pediatric breast ultrasound imaging findings at our institution and adopt such recommendations as a department-wide standard.

Helping us achieve such goals was the AHRA & Toshiba Putting Patients First grant. Our team was in search of funding that would support the improvement of pediatric care and safety in diagnostic imaging, and the grant's mission statement was exactly that. Our study

TABLE 1. Department Guidelines for Common Pediatric Breast Ultrasound Findings

Age	History/Physical Exam	Imaging	DDx	Recommendations
Neonate	NippleDischarge	Not necessary	Response to maternal hormones	Clinical follow-up
Neonate-Infant	Subareolar nodules	Not necessary	Gynecomastia	Clinical follow-up
Pre-pubertal	Asymmetric breast tissue	Normal breast tissue, duct ectasia, cystic change	Asymmetric breast buds	Clinical follow-up with optional initial ultrasound
Pubertal-Post pubertal	Palpable lump	Simple cyst or normal breast tissue	Simple cyst or breast tissue	Initial ultrasound, but no further imaging required
		Complex cyst or cystic mass	Hematoma, galactocele, abscess	Imaging follow-up to resolution +/- drainage for abscess
		Mass < 4 cm with benign features ¹	Fibroadenoma, PASH, Phyllodes tumor	US follow-up for up to 2 years (at 3, 6, 12 and 24 months), then clinical follow-up if stable ²
		Mass > 4 cm with benign features ¹	Giant Fibroadenoma, Phyllodes tumor	Surgical consultation (excision)
		Any size with suspicious features ^{2,3}	Neoplasm including malignancy, abscess, PASH, fat necrosis, galactocele	Tissue sample or refer for surgical consultation (excision)
		Any size or features in setting of cancer or prior radiation therapy to breast tissue	Metastasis	Tissue sample or refer for surgical consultation (excision)
Pubertal-Post pubertal	Breast discharge with benign features ⁴	Duct Ectasia	Physiologic, debris, papilloma or papillomatosis	Culture fluid and clinical follow-up
Pubertal-Post pubertal	Breast discharge with suspicious features ⁵	Intraductal mass or mass with intraductal extension	Clot, debris, ductal carcinoma in situ (DCIS), papilloma, intracystic papillary carcinoma	Tissue sample or refer for surgical consultation (excision)
Pubertal-Post pubertal	Subareolar nodules (Male)	Normal breast tissue	Gynecomastia	Clinical follow-up

¹Benign features: Lack of malignant findings, circumscribed margins, parallel orientation, ellipsoid, thin echogenic pseudocapsule

²Stable: No increase in size or change in symptoms. If increase in size or painful, do core needle biopsy or refer to surgery

³Suspicious features: Irregular shape, angular margins, non-parallel orientation, posterior shadowing, associated calcifications, wide transition zone, increased malignancy risk

⁴Benign features: Bilateral, multiple ducts, spontaneous or stimulated, milky, green, yellow

⁵Suspicious features: Unilateral, uniorificial, bloody, clear, spontaneous

■ **TABLE 2.** Final Pathology for Patients who Underwent Biopsy or Excision

Prevalence of Malignancy					
BIRADS 1&2	BIRADS 3	BIRADS 4	BIRADS 5	Koning*	Luhart†
0%	<2%	>2 to <95%	≥ 95%	0%	0%

*Koning, et al n =119 (84 Conventional fibroadenoma, 7 Juvenile fibroadenoma, 5 Tubular adenoma, 3 Fibroadenoma with PASH, 20 others)
 †Luhar, et al n = 9 (6 Juvenile fibroadenoma, 1 Phyllodes tumor, 1 Tubular adenoma, 1 Gynecomastia)

outlined how pediatric breast ultrasound findings were to be developed, and it reported alignment in the recommendations given by our radiologists for our referring clinicians to subsequently manage patients appropriately. The proposed budget primarily facilitated interdepartmental meetings to discuss and revise the recommendations, to further train our ultrasound technicians specifically in breast imaging, and to discuss our findings at national meetings to obtain feedback.

Intervention

We first began with a literature search and pre-intervention chart review to develop standardized recommendations for diagnostic pediatric breast ultrasound. We obtained IRB approval as well as queried the PubMed database with the search terms “pediatric” and “breast ultrasound” with and without the additional search term “BI-RADS,” the current widely accepted national adult reporting recommendations in place for adult breast ultrasound. We next performed a retrospective chart review to look at pathology for all sampled or excised breast masses at our institution with pre-operative ultrasound from the years 2013-2015. This was done to confirm that in fact, our population had a very similar low prevalence of malignancy to the peer reviewed literature.

We devised standard recommendations for common breast ultrasound findings in the pediatric population based on the results of our literature search for best practices. This included

creating a chart organized by age, common ultrasound finding, differential diagnosis, and recommendations. The recommendations underwent multi-disciplinary review by our board certified pediatric radiologists, a board certified breast-imaging radiologist, and a board certified pediatric surgeon. Revisions were made, and, following approval, the algorithm was established as department guidelines (Table 1) as well as disseminated electronically to the radiology staff for personal reference. Following implementation, feedback from the pediatric radiology and surgery staff at three-month intervals for up to one year post-implementation was elicited.

The guidelines were well received by both departments, with no change in the recommendations both at the three and one year intervals. Enforcement of the guidelines was done in an educational way by first reviewing completed reports and encouraging our radiologists to revise language used if felt needed. The availability of having one radiologist on site, Dr. Amit Sura, who was familiar with pediatric breast ultrasound findings allowed for ease of communication amongst the other radiologists when a difficult case arose and helped with synthesizing findings and developing an impression when needed.

A board certified radiologist with added qualification in pediatric radiology performed retrospective analyses of

both pre- and post-intervention breast ultrasound recommendations to assess consistency with the literature based standardized recommendations developed earlier. A Fisher’s exact test was then performed to compare the pre- and post-intervention data. A P value of <0.05 was considered statistically significant.

Results and Outcomes

From our PubMed search, two recent peer-reviewed articles offered consistent recommendations for common ultrasound findings specific to the pediatric population.^{1,2} With the additional search term “BI-RADS” an article was found that concluded that the use of BI-RADS reporting system overstated the risk of malignancy in adolescent and pediatric populations, especially for BI-RADS categories 3 and 4.³ The second article reported by Koning et al detailed the pathology of excised breast masses from a group of 119 pediatric patients and found that all masses were benign, consistent with the low prevalence of malignancy in the pediatric population.⁴

At our institution retrospective chart review, pre-intervention identified 76 diagnostic breast ultrasounds performed from January 1, 2013 to December 31, 2015. Each ultrasound was reviewed for consistency with the standardized recommendations developed for our institution. Of the 76 ultrasounds, nine

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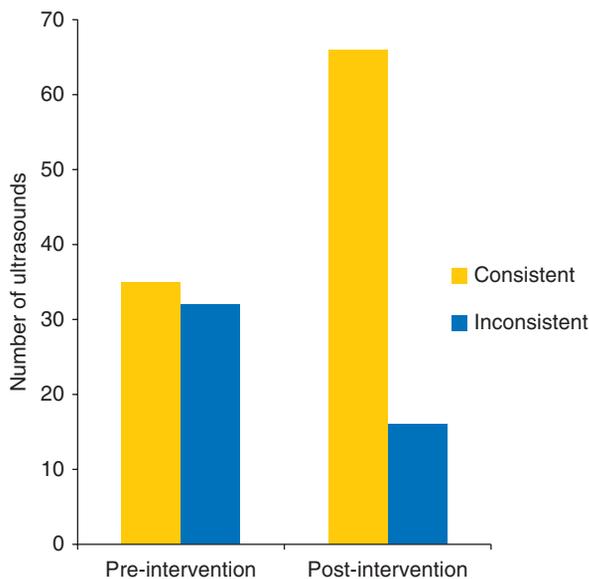


Figure 1 • Retrospective Chart Review for Consistency with Standardized Recommendations

examinations were discarded because the standard recommendations were not applicable to the ultrasound findings. Of the remaining 67 pre-intervention ultrasounds, 52 percent of the exams were found to have consistent recommendations, as shown in Figure 1. Of the nine patients who went on to surgery for biopsy or excision of their breast abnormality, either for clinical reasons or at patients' requests, the final pathology was all benign (Table 2).

Retrospective chart review of the post-intervention period identified 91 ultrasounds from January 1, 2016 to January 1, 2017. Nine examinations were discarded because the recommendations were not applicable to the ultrasound findings. The recommendations were then retrospectively applied to the remaining 82 post-intervention ultrasounds, and 66 examinations were found to have consistent recommendations (80 percent) as shown in Figure 1. A Fisher's exact test to analyze consistency of the pre- and post-intervention recommendations yielded a p value of <0.01 which was considered to be statistically significant. The final pathology for 3 of the 66 patients who underwent biopsy or excision was all benign (Table 2).

Conclusion

Diagnostic pediatric breast ultrasounds performed at an academic children's hospital demonstrated a lack of consistent, evidence based recommendations for common imaging findings. Following implementation of a literature-based standardized approach to common findings, we saw a marked improvement in the appropriateness and consistency of recommendations on diagnostic pediatric breast ultrasounds at our institution. We believe that offering consistent, specific recommendations will help decrease unnecessary follow up for pediatric patients. Specific recommendations are likely to decrease a prolonged imaging or procedural workup which can decrease patient and parental anxiety as well as generate cost savings for forgoing additional imaging.

References

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