Implementation of Office-Based Ultrasound in Academic Pediatric Otolaryngology Practices

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ABSTRACT

Educational Objectives: 1- Learn a new paradigm using office based ultrasound for evaluating and managing head and neck masses in a pediatric otolaryngology practice, 2- Learn how ultrasound for these clinical indications reduces costs, inconvenience, time to diagnosis, exposure to ionizing radiation, intravenous contrast and laboratory tests.

Background: Computed Tomography (CT) is frequently used for evaluation of head and neck masses in children, however exposure to ionizing radiation is of concern. Magnetic Resonance (MR) avoids ionizing radiation but it is slow, prone to artifact, expensive, and often requires repeat visits. Both studies may require children to be sedated. Office-based ultrasound circumvents many of the negatives associated with CT and MRI imaging.

Objectives: Demonstrate the utility of ultrasound in the evaluation and management of head and neck masses in pediatric otolaryngology patients.

Study Design: Retrospective Review. Cost-effectiveness and decision analyses; diagnostic accuracy;
Years Study Conducted: 2012-2013

Methods: Children with masses or suspected lesions in the head and neck were evaluated in an Academic outpatient setting with Ultrasound and immediate Ultrasound guided fine needle aspiration when indicated.
Outcome Measurements: Diagnostic studies; Type of treatment; Management of abnormality
Independent Variables: Age of patient; type of pathology

Results: Ultrasound identified and differentiated disorders and masses of the head and neck. Our paradigm has shifted to increased use of ultrasound in lieu of CT or MR for evaluating head and neck masses in children. There are surmountable barriers to use of ultrasound in children. In addition, a multi-disciplinary algorithm was created to ensure an uniformed organizational approach.

Conclusion: Office-based ultrasound is a diagnostic study of choice in the evaluation of head and neck masses and disorders. Ultrasound reduces costs, risks, inconvenience to the patient, time to diagnosis, and exposure to radiation and improves system efficiency.

BACKGROUND

Imaging of head and neck provides valuable and noninvasive evaluation of patients[1] that is helpful in determining further management. Historically, Computed Tomography (CT) has been used in children as a primary imaging modality for evaluation of pediatric neck masses. CT provides important and useful information on anatomy and pathology. Even though biologic effects of ionizing radiation were recognized as early as 1896, 4 months after Roentgen's discovery of x-ray, radiation injuries from diagnostic and therapeutic imaging (as in cardiac catheterization) still occur in the 21st century[2,3]. In 2010 the FDA launched an initiative to reduce unnecessary radiation exposure from medical imaging.[4] A 3 fold increase in the number of CT scans occurred over a 15 year period ending in 2007, resulting in 72 million CT scans in the US alone.[5]
Not only are children more sensitive to the damaging effects of radiation, but they also have a longer potential life span in which that damage can morph into cancer.[5,6] Straus[7] noted there are up to 7 million CT scans completed in children annually.
Pearce[8] noted for children with normal life expectancy, the lifetime excess risk of any incident cancer for a head CT scan (with typical USA dose) is about one cancer per 1000 head CT scans for young children (<5 years) Decreasing to about one cancer per 2000 scans for exposure at age 15 years.
Some practitioner may therefore switch to other imaging modalities to reduce these risks. Magnetic resonance (MR) imaging avoids ionizing radiation, but is slow, prone to artifact, expensive, and often requires repeat visits. As MR acquisition time tends to be slower many children require sedation for good quality images.
Ultrasound of the head and neck offers cost effective point-of-care imaging without radiation exposure, intravenous contrast or confined spaces. Although relatively few Otolaryngologists currently use office-based ultrasound in their daily pediatric practices, more will do so in the future due to the overwhelming advantages it offers to patients and practices. Otolaryngologists have a unique understanding of the three-dimensional anatomy of the head and neck and therefore, point-of-care ultrasound by an experienced Otolaryngologist can provide patients with timely and thorough assessments of the region.

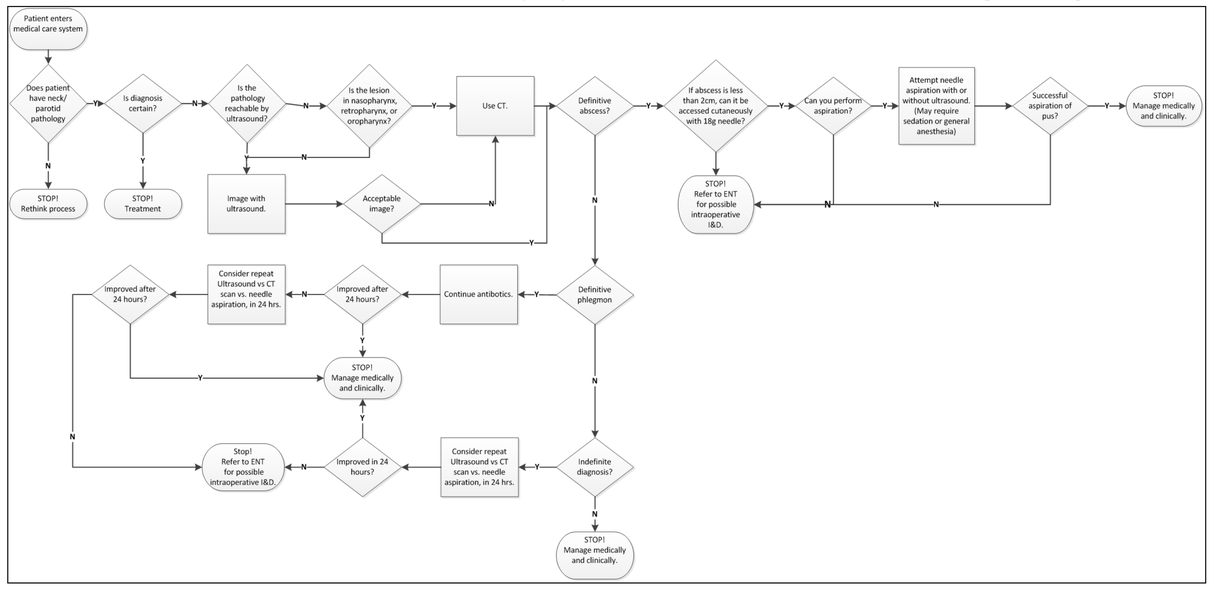
MATERIALS & METHODS

We retrospectively reviewed cases of children with masses or suspected lesions in the head and neck, which were evaluated in an academic outpatient setting with ultrasound and immediate fine needle aspiration when indicated.
We looked at diagnostic studies, type of treatment, and management of the abnormality found.
This study was approved by our Institutional review board. Statistics are descriptive.

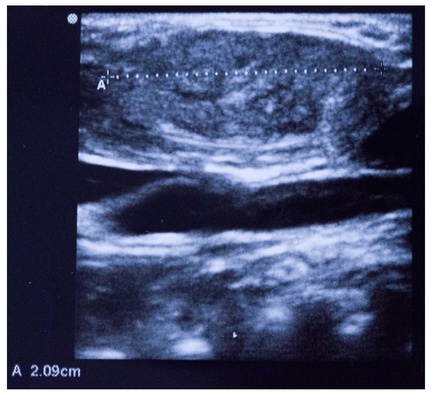
DATA

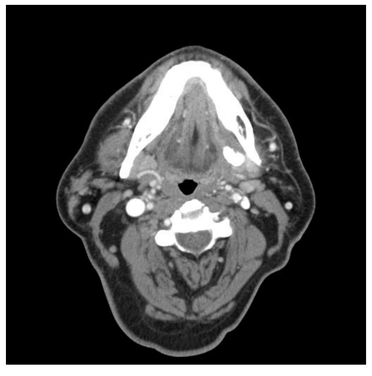
We evaluated a convenience sample of 44 cases. We excluded those that were not accessible by external ultrasound in an awake child. Therefore, we did not attempt to ultrasound suspected lesions with a transoral transducer, with the exception of one eleven year old with a recurrent floor of mouth swelling who was examined with both an external and internal tranducer. These exclusions included abscesses of the mastoid, paranasal sinuses and orbit, intracranial, paraspinous peritonsillar space and retropharyngeal space. This restricted the use of ultrasound to face, anterior and lateral neck including salivary glands.
The multidisciplinary algorithm that was created during the initial efforts to reduce the use of CT and MRI for evaluation of neck masses was used as a reference to see if the algorithm was followed.
27 patients met the criteria for evaluation and the group had 15 neck abscesses, 3 parotid (1 parotitis, 1 phlegmon, 1 abscess); 2 submandibular abscesses; 2 facial abscesses, 1 parapharyngeal abscesses, 2 cervical lymphadenopathy, 1 fibromatosis colli, 1 ranula. The abscesses were drained either by open incision or fine needle aspiration. Ultrasound guided fine needle aspiration was performed on the cervical lymphadenopathy.

Flow chart of approach to imaging



US of fibromatosis colli





CT & US left submandibular stones

DISCUSSION

Traditionally, imaging of head and neck lesions has involved CT scan. CT provides quick, readily interpretable images, which can be reconstructed in various planes. CT allows for contrast enhancement and can cover a large area of the body in a short time. Current multi detector devices can scan an entire body in seconds. The disadvantages of CT include exposure to ionizing radiation, exposure to contrast that can be nephrotoxic or induce anaphylaxis, cost[9], and lack of easy portability of the unit[10,11]. MR suffers even more from issues of cost (both initial capital –units start at US$500,000,[12] and per exam cost), building room to code for high magnetic fields, access, need for general anesthesia, and specialized non-magnetic equipment and instruments[13].
Ultrasound provides quick, point-of-care assessment, can be easily moved for use in multiple settings, and avoids the many problems of CT and MRI. Most health care facilities will have multiple ultrasound units, often for use in diverse areas such as obstetrics or acute trauma.
In evaluating head and neck masses in children, we wanted to eliminate the disadvantages of CT (and MR), and shorten the time to diagnosis and treatment. We developed an algorithm for ultrasound as the initial imaging modality to evaluate neck masses in children.
Office-based ultrasound is a diagnostic study of choice in the evaluation of head and neck masses and disorders. Ultrasound reduces costs, risks, inconvenience to the patient, time to diagnosis, and exposure to radiation and improves system efficiency.[14]

CONCLUSIONS

Ultrasound identified and differentiated disorders and masses of the head and neck. Our paradigm has shifted to increased use of ultrasound in lieu of CT or MR for evaluating head and neck masses in children. There are surmountable barriers to use of ultrasound in children. In addition, a multi-disciplinary algorithm was created to ensure an uniformed organizational approach.

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