

The role of fine needle aspiration in pediatric head and neck masses: does the yield justify the pain?

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Objective

The aim of our study was to report our own experience with utilizing fine needle aspiration (FNA) as a primary diagnostic procedure in adolescent patients with head and neck masses, examining the utility, feasibility, and appropriateness of this technique.

Study design

This is a retrospective, single-institute study that was conducted at Dammam Medical Complex from January 2004 to December 2006. All adolescent patients aged between 10 and 18 years with neck masses who underwent FNA as the primary diagnostic modality were included in our study. We excluded patients with neck masses of thyroid origin and those who were lost to follow-up.

Result

A total of 26 patients between 10 and 18 years of age were studied. All patients presented with nonthyroidal neck masses and underwent FNA. The study population was divided into three groups depending on the tissue of origin of the mass: lymph node origin (18 patients), salivary gland origin (five patients), and miscellaneous origin (three patients). FNA from lymph-node-related masses revealed lymphadenitis in about two third of the cases, whereas of the patients with masses of salivary gland origin, 60% had a diagnosis of pleomorphic adenoma. In the third group, the masses were of variable origin. There were no reported complications. The overall sensitivity and specificity were calculated and found to be more than 90%.

Conclusion

We believe that FNA as an office-based procedure is well tolerated and has a high diagnostic potential in head and neck masses. FNA in the adolescent age group has not been studied separately in the literature. FNA, apart from reassuring benignity, helps in confirming malignancy and thus in initiating early treatment.

Keywords:

fine needle aspiration, lymphadenopathy, masses, nonthyroidal, pediatric

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Introduction

Palpable masses in the head and neck region include a wide range of differential diagnosis, ranging from simple inflammatory masses to more complicated neoplasms, with both benign and malignant entities. The presentation of a pediatric patient with such a lesion is not an exception [1]. Fine needle aspiration (FNA) is a well-established diagnostic tool and plays a major role in the evaluation of and surgical planning for an adult presenting with head and neck masses, being incorporated into the diagnostic algorithm in many institutions. FNA has the following advantages over the open biopsy technique: first, FNA avoids the need for operating room facilities; second, it decreases morbidity; and third, it leads to more accurate open surgical planning if needed [2]. Despite these benefits with regard to pediatric head and neck masses, FNA has gained limited acceptance in the recent years as a minimally invasive procedure in tertiary-care pediatric centers mainly because the procedure is operator dependent, a cytopathologist experienced in working with children and assessing pediatric specimens is

required, and general anesthesia is needed in selected cases for FNA in children, especially in case the procedure is being performed by an unexperienced surgeon, thus mitigating one of the main advantages of this technique in adults. Finally, even in the presence of a benign cytological result, parental concern and pressure with regard to persistence of a benign lymph node can still eventually prompt an open biopsy [2].

The objective of our study was to report our own experience with utilizing FNA as a primary diagnostic procedure for pediatric neck masses, examining the utility, feasibility, and appropriateness of this technique in adolescent patients.

Materials and methods

This study is a retrospective, single-institute study that was conducted over a 3-year period. The source of our data was medical records and histopathology reports. All adolescent patients aged between 10 and

18 years referred to the Histopathology Department for FNA from different departments in Dammam Medical Complex, as well as from other hospitals such as Dammam Maternity and Children's Hospital, were included in our study. Patients with neck masses of thyroid origin, those who were lost to follow-up, those whose files could not be traced, and those for whom inadequate histopathology specimens were available were excluded from our study. All patients underwent office-based FNA. We found that subcutaneous injection with 1% lidocaine and 1:100 000 epinephrine was not well tolerated because of the initial discomfort caused by needle insertion and the burning sensation associated with injection. In contrast, FNA at our center was performed using a small-gauge needle, which involves one needle prick that is tolerated well by our adolescent pediatric patients.

During the typical FNA procedure, the neck mass was identified and stabilized by digital palpation, the overlying skin was cleaned with an alcohol swab, and then a 25 G needle attached to a 10 ml syringe in a syringe holder was inserted into the mass transcutaneously. By applying suction to the syringe, multiple rapid, short excursions with the needle were made within the mass, and the needle was withdrawn from the patient after the suction was released. The aspirated material was then expelled onto glass slides and direct smears were made. Data collected includes patients demographics, FNA related complications, cytopathological results, patient need for further open procedures, comparison between the final biopsy results and FNA results, and overall clinical outcomes.

Results

We included in this short analysis 32 adolescent patients presenting with nonthyroidal neck masses between January 2004 and December 2006. Six children (18.75%) were excluded from the study, three who were referred from other hospitals and whose medical records could not be traced and three who were lost to follow-up. The remaining 26 patients who were included in our study were between 10 and 18 years of age, an average of 16.48 years. There was slight female predominance: 56% girls and 44% boys. All of our patients had noticed the mass by themselves, with the duration for which the lump was present ranging from 10 days to 10 years, an average of 74 weeks (1.42 years). With regard to the characteristic of the neck masses, unilateral neck masses were detected in 84.6% of patients, whereas 15.4% of patients had bilateral masses, with 18% of all patients having multiple lumps. In all patients with bilateral masses and multiple lumps, the swellings were of the same characteristic clinically;

hence, FNA was performed on the most obvious and accessible mass.

To simplify our results, we divided the masses encountered into three groups on the basis of clinical findings and the most likely site of origin: lymph node origin (18 patients), salivary gland origin (five patients), and miscellaneous origin (three patients). FNA revealed lymphadenitis in two-thirds of patients (77.77%) with lymph-node-related masses (Table 1). One patient was diagnosed with Hodgkin's lymphoma and another, an 18-year-old boy, with metastatic squamous cell carcinoma; further investigation of the latter including computed tomography scanning of the head and neck revealed fullness in the right fossa of Rosenmuller, from which a biopsy was obtained and the final histopathological diagnosis was undifferentiated squamous cell carcinoma in the nasopharynx. Caseation granuloma suspicious of tuberculosis (TB) was diagnosed in one patient and confirmed by positivity for acid-fast bacilli on cultures. One patient was diagnosed with reactive lymphadenitis, but the patient had a family history of toxoplasmosis, and the final diagnosis was toxoplasmosis on the basis of a positive latex test. The lymph-node-related masses were located mostly in the anterior triangle of the neck in about 89% of patients, and in more than half the patients, the lump size ranged between 2 and 4 cm in its largest diameter. With the exception of the lymph node related mass case that turns to be metastatic in origin, all other lumps were soft and mobile on palpation. Of the 18 patients who had masses of lymph-node origin, three underwent excisional biopsies (16.6%); all of them showed the same findings as those from FNA.

FNA revealed masses of salivary gland origin in five patients (19%; Table 2). Among them, three patients (60%) had a diagnosis of pleomorphic adenoma: two-third of the adenomas were in the submandibular gland, and one-third of the adenomas were in the parotid

Table 1 Number and percentage of pediatric fine needle aspirations from lymph nodes and definitive diagnosis

Definitive diagnosis	N (%)
Reactive lymphadenitis	14 (87.5)
Congenital cyst	1 (6.25)
Lipoma	1 (6.25)
Total	16 (100)

Table 2 Number and percentage of pediatric fine needle aspirations from major salivary glands and definitive diagnosis

Definitive diagnosis	N (%)
Sialadenitis	2 (66.66)
Benign neoplasm	1 (33.33)
Total	3 (100)

gland. Chronic sialadenitis was diagnosed in about 40% of the patients. The third and last groups of our proposed mass classification formed the miscellaneous group. This group included three patients, one with an inclusion cyst, one with lipoma, and one with haemangioma. The first two patients were managed by surgical excision, whereas the third patient underwent involution. FNA was repeated in less than 5% of patients because of inadequacy of samples obtained from the first FNA. We did not encounter FNA related complications such as bleeding, even in the patient with haemangioma, and this is because a small-gauge needle was used; nor development of sinus even in the patient diagnosed with TB. On reviewing our overall FNA results, the overall sensitivity was found to be 90%, with a specificity of 94.4% and an accuracy of 80%.

Discussion

In 1847, Kunl [3] first described needle aspiration biopsy. About 80 years later, FNA was introduced in the USA by a surgeon; however, it did not gain popularity because of the complications associated with the use of a large needle. FNA in children was first reported by Jereb *et al.* [4] in 1978. Shaller and colleagues [5,6], in 1983, were the first to use FNA for pediatric neoplasms, they reported 100% sensitivity and specificity in their study on 32 children. Since then, FNA has become a more acceptable diagnostic procedure in the pediatric age group and is well established in the adult population. It avoids the need for open surgical biopsy in 40–75% of patients [6–9].

The differential diagnosis for pediatric head and neck lymph node masses is broad. Clinical acumen clues the physician into narrowing the differential diagnosis, taking into account various factors, such as age of onset, chronicity, anatomic location, symptoms, prior history, and results of physical examination. Although reactive lymphadenopathy remains the most prevalent pathology, the masses do not always resolve after initial treatment, thus presenting diagnostic dilemma and increasing parental concerns. Persistent or suspicious lymphadenopathy is the most common neck mass encountered in children [2,6,7,9]. Although benign, reactive lymph nodes may persist for weeks to months before diagnosis; lymphoma and other serious disease processes can occur with similar clinical presentation. FNA is the diagnostic procedure of choice for persistent lymph node swelling, with malignant features in the lymph nodes being demonstrated when the procedure is performed by an experienced histopathologist [9]; it was clearly documented in our study that reactive lymphadenitis was seen in two-third of our patients

(77.77%). In our study, we found that a small percentage of patients needed confirmatory open biopsies, which confirmed the original histopathological diagnosis, thus confirming the efficacy of FNA performed by our expert histopathologist.

Cytologically, reactive lymph nodes are well described except in some cases, such as Epstein-Barr virus-driven infectious mononucleosis; florid proliferations with markedly atypical large lymphoid cells can mimic high-grade lymphomas. It is in these cases that the use of flow cytometry is required to separate benign from malignant processes [1]. Van de Schoot *et al.* [10] found in their study that FNA is a useful initial diagnostic tool in children with persistent or suspicious peripheral lymphadenopathy to distinguish between benign and malignant disease. In patients with a history of previous malignancy, FNA is an accurate diagnostic tool in monitoring recurrence. Sensitivity, specificity, and predictive values of FNA in differentiating between benign and malignant lymphadenopathy are high (86–96%), and it was concluded that a known malignancy in the medical history does not influence the cytological accuracy of the test [10].

In developing countries, TB is a major cause for childhood morbidity and mortality. Accurate figures on the prevalence of pediatric TB are not available, which is because of the fact that health information systems in endemic countries are inadequate and only limited attention is paid to children, who contribute little to TB transmission in affected communities. The WHO estimates TB incidence on the basis of sputum smear positivity; however, more than 80% of children with TB are sputum smear negative, and extrapulmonary manifestation of TB is common in pediatric patients. Tuberculous lymphadenopathy is a common cause of peripheral adenopathy among children, and lymphadenopathy is a common clinical symptom of extrapulmonary TB in the pediatric age group, responsible for up to 50% of all extrathoracic TB cases. In endemic areas, TB is the most common cause (22–48%) of persistent cervical lymphadenopathy. Fanny and colleagues in 2012 confirmed the usefulness of FNA for investigating patients with suspected tuberculous lymphadenitis. In a prospective study conducted at the pediatric hospital in Bangui from 2007 to 2009, FNA was used to obtain samples for diagnosis of TB from 131 children aged between 0 and 17 years with persistent lymphadenitis; Ziehl–Neelsen staining for acid-fast bacilli was positive in 42.7% of samples and the culture was identified as TB in 67.2% of patients. Of the 75 samples that were stain negative, only 49 (65.3%) were culture positive, whereas 12 stain-positive samples were culture negative. Ten of the 12 stain-positive, culture-negative samples were

from patients who had received previous antimicrobial therapy. The conventional Ziehl–Neelsen staining method for smears is widely used and plays a key role in TB diagnosis; however, it has a poor sensitivity in aspirates because of the small number of mycobacterial cells. Löwenstein–Jensen culture showed 88 (67.2%) of samples to be positive, confirming the greater sensitivity this method compared with Ziehl–Neelsen staining, [11]. In our study, a caseating granuloma suspicious of tuberculosis was diagnosed in one patient and confirmed by positivity for acid-fast bacilli on cultures.

FNA of the salivary glands is a generally well-accepted technique that has high specificity. This technique yields few false-negative diagnoses, which makes the categorization of lesions into inflammatory/benign and malignant possible with a high degree of certainty. This feature of FNA alone can be extremely helpful not only in surgical planning but also in general clinical management such as antibiotic treatment or neoadjuvant chemotherapy [1]. As documented in our study, the majority of our cases of salivary gland masses were of benign neoplastic etiology, namely pleomorphic adenomas. Excisional biopsies confirmed the results of FNA with a certainty of 100%. Epithelial salivary gland tumors are very uncommon in the pediatric population and have different histological characteristics compared with those in adults, but with a similar prognosis. Clinicians should have a high level of suspicion when a noninflammatory single-mass lesion presents in the parotid and submandibular region, as there is a high likelihood of such lesions being malignant [11].

Alam *et al.* [12], in 2009, reviewed 128 children who were less than 15 years of age presenting with head and neck lesions; FNA was performed in 74 patients and cytohistological correlations were made. Benign lesions were found to be more common than the malignant variety, the most common being soft-tissue tumors (46.87%). Lymphomas were the most common tumors (22.6%) in the malignant category. Vascular lesions accounted for the most common benign tumor. The next most common tumor was salivary gland tumors, of which pleomorphic adenomas accounted for the maximum number of cases, one case each of Warthin's tumor and mucoepidermoid carcinoma was also diagnosed. In our study there was only one case of benign tumor haemangioma and two cases of malignant tumors, one case of Hodgkin's lymphomas, and one case of metastatic squamous cell carcinoma. Of the salivary gland tumors, three were pleomorphic adenomas. In general, we could not specify the incidence of any pathology as we have a small sample size.

Throughout the literature, the sensitivity and specificity of pediatric FNA was found to be above 90% [6,7]. Rapkiewicz *et al.* [1], in 2007, found the sensitivity and specificity of pediatric FNA to be 93 and 100% respectively. One year later, Anne and colleagues studied 71 children with head and neck masses who underwent FNA as the primary diagnostic modality, and they reported that 79% of open surgery in children was avoided by performing FNA. In their study FNA had a sensitivity of 100% and a specificity of 85%. The most common diagnosis encountered with FNA was benign reactive lymphadenopathy in 55% of patients. Alam *et al.* [12], in 2009, found the specificity and sensitivity of FNA to be 95.65 and 93.3%, respectively. In contrast, Wakely *et al.* [7] reviewed 112 FNAs from all body sites in children over a 15-year time span and reported similar results, with a sensitivity and specificity of 97%. In our study, the overall sensitivity was 90%, with a specificity of 94.4% and an accuracy of 80%. The high specificity leads to a confident diagnosis of malignant lesions among clinically suspicious masses of the head and neck among this age group. Table 3 summarizes the most important published literature on the use of FNA in pediatric nonthyroidal head and neck masses according to sample size, study duration, inclusion criteria, limitations, sensitivity, specificity, and accuracy.

FNA is an operator-dependent procedure, which for optimal results requires an experienced cytologist to perform the procedure and assess its results, along with good communication between the clinician and the cytologist. Another important limitation of FNA is the small sample size, which does not render sufficient material for marker studies, that is, for the pathologic characterization of malignant lymphomas. In the latter case, FNA must be followed up by a surgical biopsy that allows complete histologic, immunophenotypic, and immunogenetic workup. It is of importance to stress that previously no disturbance in nodal architecture was noted when surgical biopsy was necessary for complete diagnosis, a false-negative result of FNA can occur because the pathology may be focal rather than widespread and therefore not seen on cytologic specimens [10]. The key factor in the accurate diagnosis with FNA is the experience of the cytopathologist, which has been documented in the literature [1]; this was easily avoided in our cohort study, as all our FNA procedures were conducted by two experienced senior histopathologists who have worked in this field for more than 20 years.

For lesions that are difficult to palpate, the biopsy can be guided by imaging modalities, such as ultrasound or computed tomography scanning. Needle biopsy does not alter the histologic results if an open biopsy

Table 3 Literature review summary including the most important studies published on the use of fine needle aspiration in pediatric patients with regard to sample size, study duration, inclusion criteria, limitations, sensitivity, specificity, and accuracy

Study	Number of patients	Study duration	Inclusion criteria	Anes.	Limitations	Sen/Sps/Acc
Jereb <i>et al.</i> [4]	60	—	Children with suspected solid malignant tumors	—	—	Accuracy=97%
Schaller <i>et al.</i> [5]	32	2 years	Children (1 week–15 years) with solid tumors, and children with lesions suspected to be malignant	Sedation+LA	All patients with solid tumors of variable origin (mediastinal, visceral, and abdominal) with small number of LN origin(1) In benign lesions it is sometimes difficult to obtain enough material to make a diagnosis. (2) Lymphoma: enough droplet material should be obtained to determine cell surface markers(3) 'Small round-cell tumors' (lymphoma, rhabdomyosarcoma, Ewing's sarcoma, and neuroblastoma), electron microscopy is needed to clarify the diagnosis.	Accuracy>90%
Wakely <i>et al.</i> [7]	107	15 years and 9 months	The cytology files for all aspirates performed on patients 16 years of age and younger with masses	Without LA for palpable superficial masses. Sedation for deep aspirates	(1) Thyroid follicular adenoma(2) Lymphoma(3) 'Malignant small round-cell tumor'	SensitivitySpecificity rates of 97%
Cohen <i>et al.</i> , 1989	84	Pediatric patients	Head and neck masses	—	Did not differentiate thyroidal vs. nonthyroidal origin	Sensitivity=97% Specificity=95%
Tunkel <i>et al.</i> [8]	17	—	Patients younger than 18 years with cervicofacial masses	—	—	—
Ramadan <i>et al.</i> [6]	52	4 years	Children between 1 day and 17 years of age with head and neck masses	No LA or sedation	Cystic hygroma, hemangioma cat scratch disease, recurrent nasopharyngeal ca	Sensitivity=76% Specificity=79%
Liu <i>et al.</i> [9]	40	11 years	Patients less than 18 years of age with head and neck masses	Topical anesthetic cream	Needle biopsy may miss the true lesion in a bloody, necrotic or fibrotic mass FNA also is unable to give a specific diagnosis in cases in which histologic architecture is needed	No false positives were identified, but FNA failed to properly make the correct diagnosis in two cases
Van De Schoot <i>et al.</i> [10]	64	5 years	All children and adolescents (1–20 years) with enlarged peripheral lymph node	LA xylocaine spray	A high percentage of inadequate material (11–20%). Small sample size, which does not render sufficient material for marker studies, that is, in the pathologic characterization of malignant lymphomas	Sensitivity=92% Specificity=90%
Rapkiewicz <i>et al.</i> [1]	85	14 years	Children <18 years of age with lesions in the region of the head and neck	No anesthesia used	FNA is limited to some extent in the diagnosis of Hodgkin's lymphoma. A false-negative diagnosis was encountered in a primary parotid tumor	Sensitivity=93% Specificity=100%
Anne <i>et al.</i> [2]	71	4 years and 3 months	Children with head and neck masses	GA in 54 patients (76%), LA in 17 patients (24%).	It can be difficult to distinguish between parotid lesions that are benign and those that are malignant, and between aspirates of benign lymph nodes and lymphoma	Sensitivity =100% Specificity 85%
Alam <i>et al.</i> [12]	74	2 years	Children <15 years of age presenting with head and neck lesions	GA for orbital tumors. None in other cases	Lymphoma	Specificity=95.65% Sensitivity=93.3%Accuracy=94%
Fanny <i>et al.</i> [11]	131	3 years	All children aged between 0 and 17 years with lymphadenitis of unknown etiology for over 1 month	—	Patients who had received anti-TB treatment	Microscopy showed the presence of potential TB bacilli in 42.7% of the aspirates, and culture identified TB in 67.2% of cases

Acc, accuracy; Anes, type of anesthesia used; GA, general anesthesia; LA, local anesthesia; Sen, sensitivity; Sps, specificity; TB, tuberculosis.

is needed at a later time. FNA may also allow better planning for surgical resection and avoids disturbing the surgical planes preoperatively. Often, a preliminary diagnosis can be made by the cytopathologist at the time of FNA, thus reassuring the parents early and decreasing anxiety [9]. In any situation in which the cytology does not adequately explain the clinical presentation, open biopsy is recommended. Clinical judgment must always be used when assessing the results of FNA. Even in the setting of benign results on FNA, if clinical factors still suggest the presence of malignancy, including persistent and worsening clinical signs and symptoms, open biopsy should be pursued [2].

The main limitation of our study is its retrospective nature. In addition to this, our sample size is small.

Reported complications of FNA including ecchymosis, hematoma, a draining sinus tract, tumor tracking, and pneumothorax are rare. Liu *et al.* [9], in 2001, did not encounter any complications in their study. Similar to our study, Ramadan *et al.* [6], in 1997, did not report any complications in 29 pediatric head and neck FNAs.

Conclusion

We concluded from our cohort study that FNA has a high diagnostic potential in head and neck masses, even in the pediatric adolescent population. Apart from the role of FNA in reassuring the benignity of a lesion, it helps in confirming presence of malignancy and thus facilitates initiation of early treatment. However, expertise in performing FNA and assessing its results is mandatory to obtain adequate results and reach the correct diagnosis. It should be supplemented, if needed, with tissue diagnosis and immunohistochemical analysis. On the basis of the results of our study and

a literature search, FNA is recommended as the initial diagnostic tool in children with persistent or suspicious peripheral lymphadenopathy. It has proven to be a rapid, simple, and accurate diagnostic tool with low morbidity rates. Keeping the limitations of FNA in mind, a surgical biopsy is still obligatory in case of doubt.

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Conflicts of interest

None declared.

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