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ORIGINAL RESEARCH

Evaluation of fine needle aspiration biopsy as a diagnostic tool in pediatric head and neck lesions

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Deepti Agarwal[1]
Suprabha Sharma[2]
Shyamoli Dutta[1]
Rani Bansal[2]
Seema Awasthi[1]
Anjali Khare[2]
Maryem Ansari[1]

[1]Department of Pathology, Teerthanker Mahaveer Medical College, Moradabad, India; [2]Department of Pathology, Subharti Medical College, Meerut, India

Background: Fine needle aspiration (FNA) biopsy is a well accepted diagnostic procedure and considered to be a valuable test for initial assessment of head and neck swellings in adults. The technique has gained popularity in the pediatric population over the last decade, with varying degrees of acceptance rates, accuracy, and results among pathologists.

Objective: This study was performed to evaluate the utility of aspiration cytology as a first-line diagnostic tool in palpable head and neck masses in children, taking into account the diversity of lesions observed in this subset of the population. Cytologic analysis was correlated with histologic results for evaluating diagnostic accuracy wherever possible. The applicability of FNA biopsy in diagnosing pediatric malignant lesions was also evaluated.

Methods: This retrospective study conducted from January 2008 to December 2009 screened all pediatric cases referred to the departments of pathology at two tertiary care hospitals in India. Data from a total of 662 children aged 0–15 years presenting with head and neck masses who underwent FNA biopsy were collected. Cytologic results were interpreted and analyzed according to anatomic site. The lesions were then categorized into inflammatory, infective, and neoplastic.

Results: Of the 662 lesions, 23 cases were excluded due to inadequate material, thus the data for 639 cases were finally evaluated. Lymph node lesions predominated, accounting for 570 cases (89.2%), of which 412 (72%) cases were diagnosed as reactive and 91 (16%) cases as tubercular lymphadenitis. Other lesions aspirated were thyroid (18 cases, 2.8%), salivary gland (12 cases, 1.8%), and miscellaneous surface lumps (39 cases, 6.1%). Of all the cases, 628 (98.27%) were reported as benign and 11 (1.67%) as malignant. The positive predictive value of cytologic analysis in diagnosing malignancy was 100%, although exact typing of lesions was possible only on histopathologic examination.

Conclusion: FNA biopsy is a sensitive and minimally invasive first-line investigation in the diagnosis of head and neck masses in children. It is highly accurate in isolating and determining potentially neoplastic lesions, thus guiding the way for cases which truly require excision biopsy or other second-line investigations.

Keywords: fine needle aspiration, biopsy, tubercular, lymphadenopathy, thyroid

Introduction

Fine needle aspiration (FNA) biopsy for evaluation of a neck mass was first used by Kun in 1847, but failed to gain recognition and importance in those times.[1] Later, in 1930, Martin and Ellis rediscovered this technique in the diagnosis of various organ lesions.[2] Over a period of years, FNA biopsy has become established as an accurate, safe, and minimally invasive technique and one of the preferred first-line diagnostic tools. Performed most often for palpable swellings (commonly lymph node, thyroid,

Correspondence: Deepti Agarwal
Department of Pathology, Teerthanker Mahaveer Medical College, Moradabad, India
Tel +91 983 700 5696
Email deeptiagarwal@rocketmail.com

and salivary gland) in the region of the head and neck, it encompasses a wide range of differential diagnoses, ranging from inflammatory and infective lesions to neoplastic lesions. Accurate cytologic analysis has played a major role in evaluation of and planning for surgery of head and neck lesions in previous studies, although adequate data in the pediatric population are sparse. The technique was introduced into the routine pediatric diagnostic armamentarium only a decade ago. Earliest work reported in this direction was by Taylor and Nunez[3] on 62 cases in 1984. Because the sample sizes in previous studies were small, their clinical utility is not widely applicable. We aimed to evaluate the role of FNA biopsy in diagnosing lesions of the head and neck region and to review the diversity of lesions in pediatric patients presenting at two tertiary care hospitals. For these lesions, the results of cytology were compared with those of histopathology, wherever possible.

Material and methods

The study was conducted retrospectively in the departments of pathology at Subharti Medical College, Meerut, and Teerthakar Mahaveer Medical College and Research Centre, Moradabad, India. The target population comprised patients aged younger than 15 years presenting with palpable head and neck masses between 2007 and 2009. A computer-generated search was done to identify cases under 15 years of age who underwent FNA biopsy during the study period. Detailed information regarding the patient, lesion, diagnosis, and any histopathology was recorded from the data.

In all cases, FNA biopsy was done using a 23-gauge needle fitted to a 10 mL disposable syringe. The aspirated material was smeared on glass slides, immediately fixed in 95% ethanol, and stained with Leishman-Giemsa, hematoxylin and eosin, and Papaniculaou stain. In all cases, where there was suspicion of tuberculosis or where purulent material was aspirated, modified Zeihl-Neelsen staining was performed to look for the presence of acid-fast bacilli. Surgically excised specimens were available in 29 cases, which were routinely processed and stained with hematoxylin and eosin. These histopathology slides were reviewed and compared with cytologic reports for any discrepancy in diagnosis.

Results

Of 662 patients, adequate material was obtained in 639 cases (96.5%), and thus 23 cases were excluded from the study. Lymph node lesions were the most common swellings in the pediatric head and neck region, accounting for 570 cases (89.20%). Of these 570 cases of lymphadenopathy, 481 (64.4%) cases were diagnosed as reactive and 91 (14.2%) as tubercular lymphadenitis. The other lesions aspirated were thyroid, salivary gland, and miscellaneous surface lumps. Gender distribution of the 639 cases showed a male predominance (n = 512, Table 1). The majority of lesions were diagnosed as benign (in 628 cases). Diagnosis of malignancy was made in 11 cases (Table 2). Histopathologic correlation was possible in 29 cases (including all the reported malignancies). All the malignant cases were confirmed by surgical biopsy. Thus, the positive predictive value of cytologically malignant cases was 100%.

The highest frequency involving the head and neck in pediatric cases in our study involved lymph nodes, the most common being reactive lymphoid proliferations (72%), followed by tubercular lymphadenitis (16%) and granulomatous lymphadenitis (5.2%). Zeihl-Neelsen staining was performed in 145 suspected cases and revealed positivity for acid-fast bacilli in 91 (62.7%) of cases, all involving lymph nodes. Positive smears showed cytologic features resembling epithelioid cell granuloma with or without necrosis or the presence of only caseous necrosis. Cases where tubercle bacilli were not seen in the presence of granulomas were classified as granulomatous inflammation. Similarly, cases with necrosis in the absence of acid-fast bacilli were classified as suppurative inflammation. The cytologic diagnosis of non-Hodgkin's lymphoma and histiocytic and immunoblastic lymphadenopathy was in correlation with histologic examination.

There were 18 cases with thyroid enlargement, including 15 females and three males. Seventeen cases were diagnosed as benign lesions, and one case was reported as papillary carcinoma of thyroid. Cytologic features observed in the patient with papillary carcinoma included clusters and papillaroid structures of cells exhibiting intranuclear cytoplasmic inclusions and nuclear grooving (40×), with thick chewing gum-like colloid seen in the background (Figure 1). Histologic correlation revealed papillae lined by follicular cells with features of optical clearing, nuclear grooving, and intranuclear cytoplasmic inclusions (Figure 2).

In a case reported as Hashimoto thyroiditis, a smear showed background lymphocytes, plasma cells, Hurthle

Table 1 Gender distribution of cases according to site of lesion

Site of lesion	Male (%)	Female (%)	Total cases (%)
Lymph node	481 (75.2)	89 (13.9)	570 (89.2)
Thyroid	3 (0.4)	15 (2.3)	18 (2.8)
Salivary gland	6 (0.9)	6 (0.9)	12 (1.88)
Miscellaneous	22 (3.4)	17 (2.6)	39 (6.12)
Total	512 (80.1)	127 (19.9)	639 (100)

Table 2 Final diagnosis of head and neck lesions made on fine needle aspiration biopsy

Lymph node	Cases (n)	Thyroid	Cases (n)	Salivary gland	Cases (n)	Miscellaneous	Cases (n)
Reactive	412	Colloid goiter	13	Sialadenitis	5	Vascular hamartoma	11
Tubercular	91	Lymphocytic thyroiditis	2	Mucus retention cyst	3	Epidermal inclusion cyst	10
Granulomatous	30	Hashimoto thyroiditis	1	Abscess	3	Dermoid cyst	6
Suppurative	24	Papillary carcinoma	1	Pleomorphic adenoma	1	Lymphangioma	3
Non-Hodgkin's lymphoma	7	Thyroglossal cyst	1			Parasitic cyst	2
Histiocytic lymphadenopathy	2					Lipoma	2
Immunoblastic lymphadenopathy	4					Small round cell tumor	3
						Fibromatosis	1
						Benign mesenchymal tumor	1
Total (639)	570		18		12		39

cells, and epithelioid cells. Hashimoto's can be commonly misdiagnosed as colloid/nodular goiter if smears are hypocellular and follicular cells or Hurthle cells, or lymphocytes are scarce or absent.

Patients with salivary gland lesions comprised six males and six females, with parotid gland involvement in three cases and submandibular gland involvement in nine cases. Only a single case of pleomorphic adenoma of the parotid gland was encountered in our study, which was later confirmed on histopathologic examination (Figures 3 and 4).

Cases with palpable lumps elsewhere in the head and neck region (n = 39) were grouped into a miscellaneous category, in which 22 patients were males and 17 females. Histopathologic examination was advised in all three cases, where a cytologic diagnosis of small round cell tumor was given. A final diagnosis on tissue biopsy revealed neuroectodermal tumors in two cases and embryonal rhabdomyosarcoma in one case. In two cases with eyelid swelling, clear watery fluid was obtained with scant cellularity and predominantly comprised eosinophils, and the cytologic diagnosis was given as a parasitic cyst. Histopathology later confirmed these cases to be *Cysticercus cellulosae*.

Diagnosis of fibromatosis and benign mesenchymal tumor was given in one case each. Smears from fibromatosis were paucicellular, comprising spindle-shaped cells with oval to spindle nuclei and inconspicuous nucleoli. Histopathologic confirmation was not possible in these cases.

Discussion

Head and neck masses often pose a challenging diagnostic problem for the clinician. Malignancy remains an important differential diagnosis, with a neck mass often being the first and only symptom of the disease.[4] Although excision biopsy is the most accurate method of diagnosis, the use of FNA

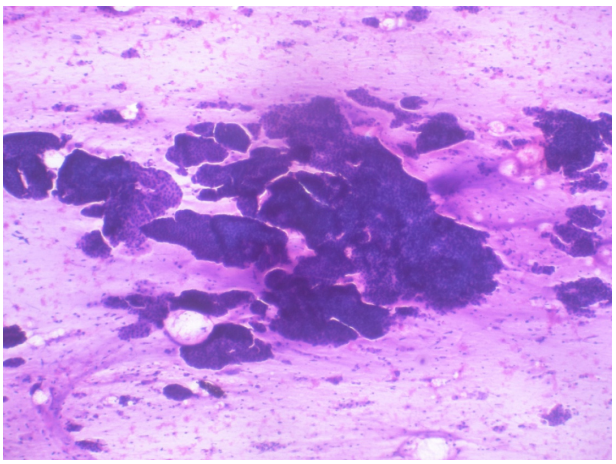

Figure 1 Cellular smear showing papillary structures of epithelial cells with nuclear moulding. Leishmann Giesma, 10×.

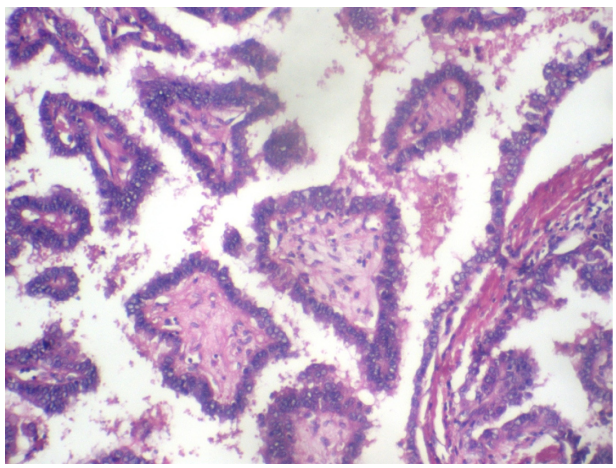

Figure 2 Section showing papillae lined by follicular cells exhibiting optical clearing of nuclei. Hematoxylin and eosin staining, 10×.

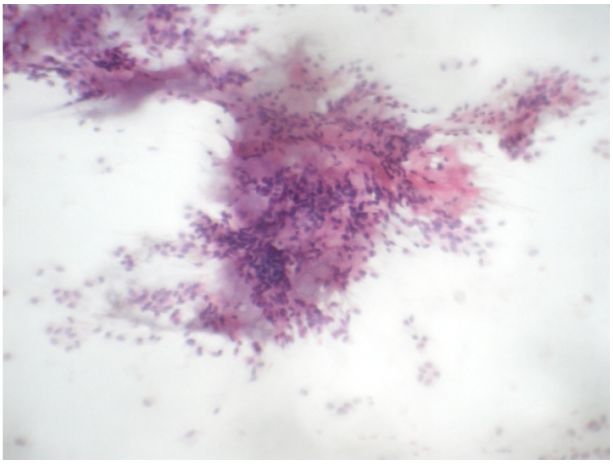

Figure 3 Cytologic appearance of chondroid and myxoid material amidst which are lying sheets of epithelial cells. Hematoxylin and eosin staining, 10×.

biopsy is becoming popular as the first diagnostic step in the evaluation of head and neck masses, especially in adults. The utility of FNA biopsy in children has been illustrated in many studies.[5–10] As reported by Howell, the use of FNA for superficial palpable lesions is gaining momentum in the pediatric patient population.[6] To date, research detailing application of FNA to lesions of the head and neck in pediatric populations and the number of cases evaluated are limited. Moreover, some studies have limited their focus to features of malignant lesions, such as small round cell neoplasms or salivary gland lesions.[8–10] The range of lesions which can be reliably diagnosed by this method is rapidly expanding. Lack of need for sedation or general anesthesia is an additional benefit in the pediatric patient. In addition to rapid diagnosis, tissue samples retrieved from FNA biopsy can be processed further for other techniques, such as flow cytometry, cytogenetics, and electron microscopy.[7,8]

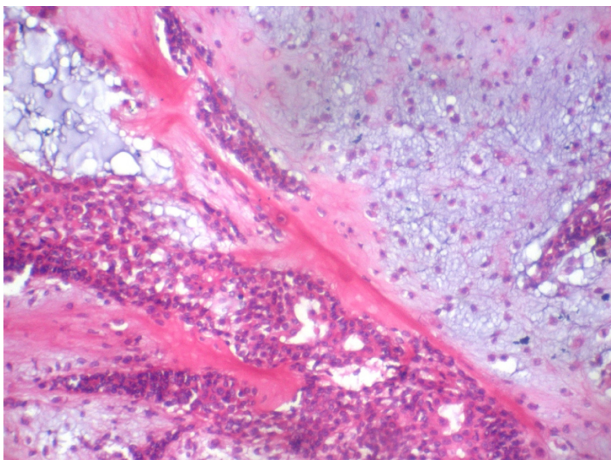

Figure 4 Section exhibiting sheets of epithelial cells amidst chondroid, myxoid, and mucoid stroma. Hematoxylin and eosin staining, 10×.

The results of 662 aspirates from head and neck masses revealed an infective etiology in 125 cases (tubercular, abscess, suppurative), benign lesions in nine cases, and malignant lesions in 11 cases.

An unsatisfactory/inadequate aspirate was observed in 23 cases (3.47%) in our study, which is much lower than reported in other studies (9%–15%).[11,12] Although Fernandes et al[4] have reported the lowest rate of inadequate sampling of 0.64% in 662 adult cases, Jain et al[13] reported the rate to be 6% in their study. Unsatisfactory aspirates in previous studies could be due to lack of a trained cytopathologist, poor handling of aspirated material, or small size of the lesion to be aspirated.

As observed in studies by Smallman et al,[11] Jain et al,[13] Dhingra et al,[14] and Russ et al,[15] we also found that the most common lesions involving the pediatric head and neck are of lymph nodes, the most common being reactive lymphoid proliferations (72%, n = 412), followed by tubercular lymphadenitis (16%, n = 91) and granulomatous lymphadenitis (5.2%, n = 30). The present study did not make any attempt to categorize the type of reactive lymphadenopathy. The diagnosis of reactive lymphadenopathy was made by presence of a polymorphic cell population and tingible body macrophages.

We observed positivity for acid-fast bacilli in 62.7% of the suspected lesions (n = 145), compared with only 4% positivity reported by Bari et al[16] in their series at Quetta. This emphasizes the burden of tuberculosis in our country and correlates well (18%–43% positivity) with other studies done in developing countries.[13,14] Problems appear in arriving at a definitive diagnosis of tuberculous lymphadenitis when the aspirate shows a polymorphous picture with occasional epithelioid cells but with an absence of Langhans giant cells or caseous necrosis, making it necessary to resort to excisional biopsy for a definitive diagnosis. This is particularly true in children, in whom a similar picture may be seen in cases of reactive hyperplasia due to viral or *Toxoplasma* infection, because the mere presence of epithelioid cells is not diagnostic of any specific condition.[14] Because tuberculosis is very common in India, the presence of single acid-fast bacilli, along with other signs and symptoms of disease, mandate antitubercular treatment. Even a clinically relevant case of granulomatous lymphadenitis (in the absence of acid-fast bacilli) is considered to be tuberculous lymphadenitis and given a trial of antitubercular treatment, unless proved otherwise.

In our study we reported only 11 (1.67%) cases of malignancy in various head and neck lesions. The predominance of benign lesions (98.27%) observed in our study is in concordance with previous studies done by Jain et al[13] and Tayler and Nunez,[3] although Dave et al[8] and Dhingra et al[14] reported a high rate (11.5%) of malignant lesions in their studies. These differences may be related to the geographic distribution of the sample population or type of cases referred to our institutions. The positive predictive value in diagnosing malignancy cytologically was 100% in our study. Jain et al also reported a similar accuracy of 100% in diagnosing malignant lymphadenopathy. On the contrary, all the earlier studies have shown it to be 80%–90%.[3,12,17] This can be attributed to the type of lesion aspirated and operator technique of sampling from multiple sites, thus improving the chances of aspirating malignant cells.

One case each of benign mesenchymal tumor and fibromatosis was reported cytologically. However, histopathologic correlation was not available in these cases. FNA biopsy usually does not encounter problems in distinguishing high-grade soft-tissue sarcomas from benign lesions. However, borderline and low-grade lesions are susceptible to being missed. Accurate typing and grading of the tumor is not possible in many cases by FNA alone. Almost all studies of soft-tissue tumors have reported this limitation of FNA biopsy.[18]

Limitations of our study included the fact that evaluation of grading of mycobacterial infection on acid-fast bacilli smears was not performed. Because mycobacterial grading does not provide a true guide to treatment, it is infrequently advised by clinicians. However, because our reporting includes a measure of density in terms of occasional, single, a couple, or many tubercular bacilli observed in the field, the same provides a fairly good indication of the treatment strategy. Flow cytometry was not performed in any case, as this modality was unavailable at both the institutions. Instead, histological examination was performed for doubtful lesions in order to determine the final diagnosis, as referral to other centers for cytometric evaluation would have added to diagnostic delay with more financial burden on patients without any added diagnostic yield. Due to ignorance and poor patient compliance, the follow-up of all benign or infective cases is not practically feasible in a developing country such as India, so was not done in our study. A sample size of 11 cases with cytologic diagnosis of malignancy is still too small to confirm an important role for FNA in diagnosing pediatric malignancies.

In today's economic environment of increasing health care costs, any technique which speeds up the process of diagnosis, limits the physical and psychologic trauma to the patient, and saves hospitalization expenditure will be of tremendous value. FNA biopsy is more convenient for the patient and their families, with minimal loss of time from work.[3,19] It also reduces the need to perform excision biopsy in many cases, which often requires time off from work, preoperative blood tests, and radiologic testing. In the pediatric population, FNA helps save children from having to undergo anesthesia and from suffering the complications of excision biopsy. It also helps surgeons to select, guide, and modify their planning in patients requiring surgery.

Conclusion

We conclude that FNA biopsy is a simple and rapid procedure which can be carried out with ease in children, and with minimal problems. Owing to its accurate diagnostic potential in benign and malignant lesions, we recommend FNA biopsy as the first-line investigation in diagnosing head and neck swellings in the pediatric age group.

Disclosure

The authors report no conflict of interest in this work.

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