

The role of fine needle aspiration cytology in the diagnosis of orbital lesions

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ABSTRACT

Context: Fine needle aspiration cytology (FNAC) in orbital lesions has gained importance over the last 3 decades, especially with the advent of imaging studies. **Aims:** The study was undertaken to evaluate the role of FNAC as a diagnostic tool in patients presenting with orbital mass lesions. **Subjects and Methods:** Patients of different age groups presenting with orbital lesions were studied over a period of 2 years. The 38 patients selected for this study were evaluated clinically by thorough general and ophthalmological examination, and then were investigated with computed tomography (CT) scanning (both axial and coronal planes). Each patient included in this study was then subjected to FNAC under direct vision or under ultrasonography or CT guidance with a sterile 22 gauge needle without anesthesia. **Results:** The age of the patients varied from 2 to 72 years. On cytology, four cases were diagnosed as nonneoplastic and the remaining 34 (89.48%) as neoplastic lesions. In the neoplastic group, benign tumors (20; 58.8%) outnumbered malignant (14; 41.2%). The distribution of malignant lesions was more heterogeneous with a predominance of lymphoma involving the orbit. Surgical biopsy was done in 27 cases. Surgical biopsy report correlated with the FNAC report in 23 out of 27 cases. The sensitivity was 86.6%, specificity 100%, and positive predictive value 100%. **Conclusion:** FNAC is a useful, safe and cost-effective method of diagnosing orbital pathology. Image guidance is helpful especially in deeply situated nonpalpable lesions.

Key words: Fine needle aspiration cytology, lesions, orbit

INTRODUCTION

Orbit has a complex structure of neurosensory, vasculomotor, and secretory tissue types confined to a small area surrounded by bones, nasal tissues, and intracranial structures. In Asian population, age adjusted incidence rates of orbital tumors are 0.3 per 1,000 in males and 0.2 per 1,000 in females with worldwide incidence of about 0.8 per 1,000 population per year.^[1] The overall 5-year relative survival for 2003-2009 worldwide was 81.7%. Five-year relative survival by race and sex was: 81.2% for white men; 81.5% for white women; 75.5% for black men; and 83.4% for black women.^[1,2] Orbital tumors represent a diagnostic challenge to the clinicians. The diversity and

rarity of the orbital lesions compounded by the difficulty in obtaining direct surgical biopsies make fine needle aspiration biopsy (FNAB) a useful tool in diagnosing orbital lesions.^[3-6] With the advent of noninvasive techniques like computed tomography (CT) scan and magnetic resonance imaging (MRI), the extent and size of the tumors can be clearly demarcated; but the pathological nature of the lesion may remain elusive. Since 1975, when Schyberg first used FNAB in orbital lesions,^[7] the technique has improved considerably. It is a simple, quick, and accurate method of tissue diagnosis and can be performed as an outpatient procedure. The cytology of the aspirate has been found to correlate with the postoperative histology in many studies. A varying sensitivity of 50-90% has been reported.^[6,8,9] FNAB provides ophthalmologists with a reliable, rapid, and cost-effective method of diagnosis of the orbital lesions.^[10]

Objective

The aims of the study were to find out the correlation between the clinical diagnosis of orbital lesions and tissue diagnosis by FNAB and also to correlate the cytodagnosis with histopathology.

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SUBJECTS AND METHODS

Patients presenting with orbital lesions of different age groups and sexes were included in this study. Patients with pulsatile proptosis, thyroid-associated ophthalmopathy, and orbital cellulitis were excluded from this study. The 38 patients selected for this study were evaluated clinically by thorough general and ophthalmological examination, and then were investigated with CT scanning (both axial and coronal planes). Each patient included in this study was then subjected to FNAB. Anterior orbital and palpable tumors were approached transcutaneously under direct vision. Posterior orbital and nonpalpable tumors were approached under ultrasound (US) or CT guidance. The FNAB procedure was performed with a sterile 22 gauge needle without anesthesia.

Ethics

Ethical clearance had been taken from Ethical Committee of our institution. Informed consent had been taken from patients.

Study design

Hospital-based, cross-sectional, observational study.

Study duration

Two years.

RESULTS

A total 38 patients presenting with orbital lesions and having the clinical diagnosis of orbital tumors were analyzed during a period of 2 years. The age of the patients varied from 2 to 72 years with the maximum number of patients in the 21-30 years age group [Figure 1]. Female cases outnumbered males (male:female ratio 1:1.2). Thirty-five out of 38 cases yielded adequate material for cytologic analysis. In the remaining three cases, diagnosis was made only after histopathological examination. On cytology, four cases turned out to be nonneoplastic and the remaining 34 (89.48%) were diagnosed as neoplastic lesions. The nonneoplastic lesions comprised of three cases of inflammatory disease and one dermoid cyst. In one of the three cases of inflammatory lesion, the aspirate yielded frank pus, showed dense neutrophilic infiltrate, and the patient responded to antibiotic therapy. The other two cases showed blood tinged tissue fluid aspirate. Cytology showed inflammatory cells composed of lymphocytes, plasma cells, histiocytes and a few collections of spindle-shaped cells. A provisional diagnosis of inflammatory pseudotumor was given on cytology and the patient responded to steroid therapy. In the neoplastic group, benign tumors (20; 58.8%) outnumbered malignant (14; 41.2%); the commonest benign tumor being pleomorphic adenoma arising from

lacrimal glands. The distribution of malignant lesions was more heterogeneous with a predominance of lymphoma involving the orbit [Table 1 and Figure 2a].

In the pediatric age group, a higher number of malignant tumors were found (62.5%) compared to other age groups [Figure 3].

Morphologically, adenoid cystic carcinoma could be easily diagnosed by the presence of typical hyaline globules and uniform small cell [Figure 2b]. The tumors posterior to the globe were aspirated under CT guidance. One of these cases was diagnosed as meningioma which showed balls and whorls of uniform round to oval cells with moderate amount of eosinophilic cytoplasm [Figure 2c].

In our series, we came across three cases of rhabdomyosarcoma, two of them showed rhabdomyoblasts. Presence of binucleate cells also served as diagnostic clues. In the third case, a diagnosis of malignant small round cell tumor was given suggesting the possibility of a rhabdomyosarcoma. This was confirmed by histopathology. Sections were subsequently confirmed by immunohistochemistry (positive for desmin, vimentin, and negative for cytokeratin, neuron specific enolase) [Figure 4].

Surgical biopsy was done in 27 cases (excisional biopsy in 25 and incisional biopsy in the remaining two). Surgical biopsy report correlated with the FNAB report in 23 out of 27 cases. One of the cases of histiocytosis X was misdiagnosed as inflammatory lesion. The biopsy showed classical features of eosinophilic granuloma [Figure 2d]. On review of the cytology smears, large number of eosinophils could be identified along with scattered bizarre histiocytes, with indented and grooved nuclei. The only case of malignant mixed tumor in our series was interpreted as benign on cytology. Histopathology showed a malignant tumor with well-preserved benign areas. Two of the three

Table 1: Distribution of neoplastic lesions

	No. of cases	Percentage among neoplastic
Benign	20	58.8
Pleomorphic adenoma	8	23.5
Hemangioma	6	17.6
Meningioma	3	6.8
Neurofibroma	1	2.9
Optic nerve glioma	1	2.9
Schwannoma	1	2.9
Malignant	14	41.2
Adenoid cystic carcinoma	2	6
Malignant mixed tumor	1	2.9
Lymphoma	5	14.7
Rhabdomyosarcoma	3	8.8
Orbital histiocytosis X	1	2.9
Chloroma	1	2.9
Leukemic orbital deposit in ALL	1	2.9

ALL: Acute lymphoblastic leukemia

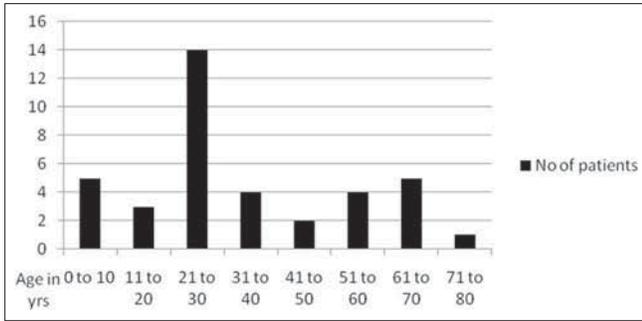


Figure 1: Diagram showing age distribution of orbital lesions

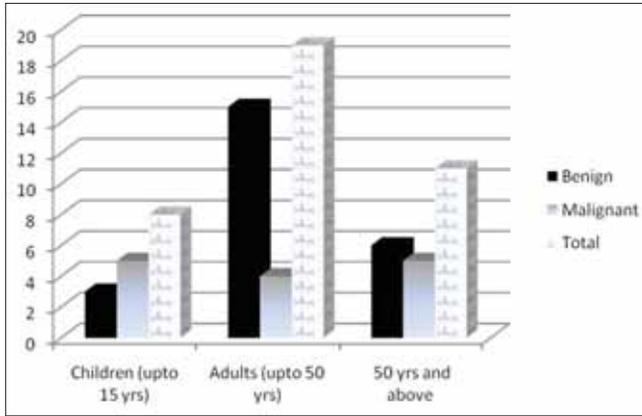


Figure 3: Diagram showing the distribution of benign and malignant lesions in children, adults, and elderly

inadequate aspirates in our series were later diagnosed as inflammatory pseudotumor. Comparing the cytodagnosis with histopathology, the sensitivity was 86.6%, specificity 100%, and positive predictive value 100% [Table 2].

DISCUSSION

In our series, a specific diagnosis could be offered from FNAB in 35 out of 38 cases. Thus the sensitivity of orbital FNAB in our series was 86.6%. Various authors have reported a sensitivity of 80-95%.^[4,5,9-12] The literature shows varied distribution of orbital lesions diagnosed on FNAB. Benign lesions dominated the picture in some series.^[13] Others showed equal representation of benign and malignant tumors.^[6] In one cumulative series incorporating the data of different studies, malignant tumors dominated the picture. This might be due to the inclusion of periorbital masses in that series that incorporated a large number of cases of basal cell carcinoma.^[14] In the present series, benign lesions outnumbered the malignant cases with pleomorphic adenoma being the commonest lesion. In literature, inflammatory pseudotumor has been reported as the most common benign lesion.^[6,10] Two of the three inadequate aspirates in our series were later diagnosed as inflammatory pseudotumor. FNAB is said to have a limited role in the evaluation of pseudotumors, especially in cases

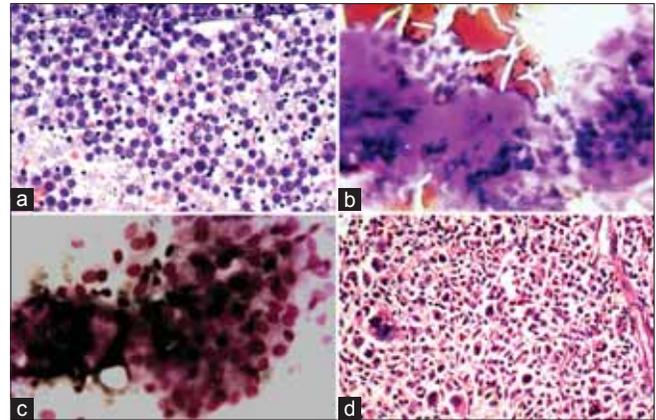


Figure 2: (a) Cytosmear showing dispersed uniform large cells with prominent nucleoli in non-Hodgkin's lymphoma (Papanicolaou (PAP), x200). (b) Cytosmear showing hyaline globules and clusters of uniform cells with high nucleus:cytoplasm (N:C) ratio and hyperchromatic nuclei in adenoid cystic carcinoma (May-Grünwald-Giemsa, x400). (c) Cytosmear showing balls and whorls of uniform round-to-oval cells with moderate amount of eosinophilic cytoplasm in meningioma (PAP, x400). (d) Section showing sheets of eosinophils and scattered bizarre histiocytes with irregular indented nuclei in eosinophilic granuloma (H and E, x200)

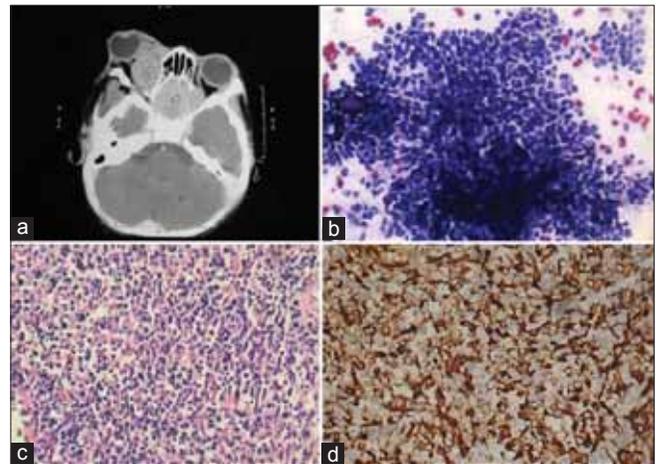


Figure 4: (a) Computed tomography (CT) scan shows large solid mass destroying orbit, nasal cavity with intracranial extension. (b) Cytology showed malignant small round cell tumor (LG, x100). (c) Histology showed rhabdomyoblasts interspersed with small round cells (H and E, x200). (d) Desmin positivity by tumor cell (desmin, x200)

where there is a predominantly fibrous matrix, with reduced cellularity.^[4] Moreover, the histological architecture is not preserved in FNAB, resulting in a nonspecific picture in pseudotumors.

Meningiomas are the most common benign epithelial neoplasm observed in previous reports of orbital fine-needle aspiration.^[5,15-17] The presence of oval to round cells with a whorled pattern and psammoma bodies in a clinically suspicious lesion may suggest the correct diagnosis. In our case, recognition of the cytologic pattern allowed a specific diagnosis. Pleomorphic adenoma has been reported to be more prevalent in some series.^[13] Similarly, in our series, pleomorphic adenoma dominated the benign tumors.

Table 2: Diagnostic accuracy of orbital FNA in histologically-confirmed cases

FNAB results	Histopathological diagnosis		
	Positive	Negative	Total
Malignant	13	0	13
Benign	2	9	11
Inadequate	1	2	3
Total	16	11	27

FNAB: Fine needle aspiration biopsy, sensitivity 86.6%, specificity 100%, positive predictive value 100%

Lymphoid lesions were also common in other series.^[14] Our series contained five such lesions, and was found to be the most common malignant tumor. Classification of orbital lymphoid lesions is controversial because morphologic evaluation and immunophenotyping do not always predict the natural course of these proliferations.^[18] The treatment is principally dictated by the location and extent of the lesions rather than the morphologic appearance of the biopsy. In these instances, documentation that the tumor is lymphoid may be all that is necessary and FNAB alone may suffice. However, if studies for gene rearrangement or more detailed classification are desired, open biopsy or immunophenotypic analysis of aspiration biopsy is required.^[14]

Rhabdomyosarcomas have been specifically diagnosed by orbital FNA in previous series.^[5,9,19-22] Due to lack of cytological characterization, it is not uncommon to get a picture of round cell tumor in cases of both rhabdomyosarcoma and retinoblastoma.^[21] As retinoblastomas may show orbital extension, the differentiation becomes important. Imaging studies including computed tomography (CT) scan have important role to play in this regard. However, a careful examination of the cytosmear may provide important diagnostic clues like rosettoid pattern in case of retinoblastoma and cells with tapering cytoplasm in cases of rhabdomyosarcoma. Immunohistochemistry for a panel of round cell tumor is helpful in this case: Desmin, myosin positivity indicates rhabdomyosarcoma; whereas neuron-specific enolase, S-100 positivity favors neuroblastoma and retinoblastoma.

A specific diagnosis of eosinophilic granuloma has been made on fine needle aspiration cytology (FNAC).^[11] Similarly, in our case, the presence of eosinophils, multinucleated giant cells, and histiocytes with characteristic lobated nuclei suggested the diagnosis. Histopathology confirmed the diagnosis.

Palpable orbital lesions are easy to sample. However, when the mass is placed posteriorly, accurate placement of the needle poses a problem. This has to be tackled by ultrasound or CT guidance.^[3] In six out of 38 patients of the present series, the orbital mass was behind the equator and could not be palpated easily. Ultrasound guidance in

these cases ensured accurate placement of the aspirating needle. This lent precision to a blind procedure and considerably increased the yield of positive results.^[10] US have recently been recognized as a useful and versatile guidance technique. It has many advantages over CT guidance, including real time imaging, decreased procedure time, cost, portability, and lack of ionizing radiation. Clear visualization and effective performance of FNAB is possible under US guidance in lesions located in various parts of the orbit. It is claimed that lesion as small as 1.5 cm can be effectively sampled by this method.^[13]

Local anesthesia was not used during FNAB in our series. Other studies also, did not use local anesthesia as it might cause swelling and distortion of the orbital tissues and changes in echo characteristics. Moreover, it is important to keep the number of needle punctures to minimum in orbital lesion as orbital hemorrhage may lead to serious complication. The importance of using small size needle has been emphasized in literature. The recommended needle length is 3.75 cm for adults and 2.5 cm for infant.^[5]

Numerous complications have been reported in the literature, including retrobulbar hemorrhage, blindness, motility disturbances, ptosis, and globe perforation with vitreous hemorrhage.^[23] It is recommended that only trained ophthalmic surgeons, well-versed with orbital anatomy and strictly following the standard technique, should perform FNAB of the orbit.

To conclude, FNAB is a useful, safe, and cost-effective method of diagnosing orbital pathology. Image guidance is helpful especially in deeply situated nonpalpable lesions. FNAB may yield valuable diagnostic information, thus obviating major surgical procedures in large number of patients.

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