Fine Needle Aspiration Cytology of Intra-Osseous Lesions of The Oral Cavity

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Abstract: *Fine needle aspiration cytology (FNAC) is a valuable adjunct to the careful physical examination of patients. It is a much simpler technique and can sample cells from deeper parts of the neoplasm in contrast to routine biopsy that may sometimes fail to procure samples from the depth of the lesions. Greatest benefit is its speed with which the diagnosis is available with minimum expenditure.This study was undertaken to assess the usefulness of aspiration cytology in lesions of jaw bones and to demonstrate cytologic findings of different lesions. Thirty five cases of radiolucent lesions of the jaws were subjected to fine needle aspiration. Only in 31 cases adequate material was obtained. In 4 cases inadequate smear was obtained. There was 100 % accuracy in determining benignity and malignancies of tumors when correlated with clinical and roentgenographic features. Out of 31 cases 20 were benign and 11 were malignant. In this study out of 31 aspirates a specific cytologic diagnosis was possible in 27 cases (87.10%). In the remaining 4 cases only nonspecific diagnosis could be made. A specific diagnosis was possible in 19(95%) of the 20 benign lesions and 8(72.73 %) of the 11 malignant lesions.*
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I.   Introduction

FNAC is the sampling of a palpable or roentgenographic mass by means of a fine needle with negative pressure supplied by an attached syringe. It dates back to 1847 when Kun reported needle recovery of cells for microscopic examination. From its inception until the early 1900s its development was slow. FNAC of the head and neck region was pioneered by Martin in early 1930s. Major achievements at the Karolinska institute by researchers such as Franzen et al(1960) was the development of the technique known today as FNAC with 20 gauge or smaller needles. The diagnosis of bone lesions by needle biopsy was first introduced by Coley et al 1931.

The fundamental indication for FNAC is diagnosis of lesional mass that is palpable or visible by radiographic imaging methods. It is useful to verify recurrences or persistence of a neoplasm, confirm a suspected malignancy, differentiate benign and malignant conditions , document malignancy for untreatable patients, to evaluate metastasis of malignant disease, to diagnose multiple tumors and to identify infectious organisms. It is necessary to obtain an adequate cellular sample and pathologist must be expert at identifying individual cells. Its accuracy, safety and usefulness have been demonstrated. It has many advantages including ease of use, cost effectiveness and convenience. It is a much simpler technique can sample cells from deeper parts of the neoplasm in contrast to routine biopsy that may sometimes fail to procure samples from the depth of the lesion. Greatest benefit of FNAC is its speed with which diagnosis is available with minimum expenditure, so that treatment planning or even the final treatment can be instituted at the earliest.

Intra osseous lesions of the jaws may be congenital or acquired, unilocular or multilocular, destructive or expansile. 100% accuracy rate of FNAC reported by Layfield et al (1987) [1] in diagnosing primary bone lesions encouraged us to take up this study. This study was done to assess the usefulness of FNAC in jaw lesions,to demonstrate cytologic findings of different lesions , to compare these findings with histologic diagnosis to assess the accuracy, to determine the value of FNAC in differentiating benign and malignant lesions of the jaws and to ascertain whether it can serve itself as a reliable diagnostic tool for the proper clinical management.

II. Materials And Methods

Thirty five cases of radiolucent lesions of the jaws were subjected to fine needle aspiration. The relevant roentgenograms were also available. All aspirations were performed on an outpatient basis in a dental chair. There were 17 males and 18 females, in the age range of 3 months to 60 years. In those cases with a palpable swelling the needle was inserted directly in to the lump and in those cases with no visible lesion the needle track was chosen based on radiographic findings.

Material was aspirated with a 20 or 22 gauge needle attached to 5 ml disposable syringe. The needle was inserted intra orally in all cases. The needle was inserted to the desired depth in to the tumor and a firm suction was applied to create negative pressure in the syringe by pulling out the piston. The needle was moved 2 or 3 times in different directions while maintaining the negative pressure. The piston was released to allow the pressure to equalize to prevent spattering of cells and the needle was then withdrawn. The material thus obtained was expressed on or more glass slides and spread with another slide. The smears were immediately fixed in ether alcohol and stained by papanicolaou.

The histopathologic study of the corresponding lesions was performed and correlated with cytologic findings.

III. Observations And Results

FNAC of 35 intraosseous lesions was done in the present study and the results were entered in the tables I to V. The 35 aspirates were grouped in to benign lesions, malignant lesions and inadequate smears. Of the 35 aspirates 20 (54.14%) were benign and 11(31.44%) were malignant. 4 smears (11.42%)were inadequate. All the 20 benign lesions diagnosed cytologically were benign in their histology. All the 11 malignant lesions diagnosed cytologically were also in comparison with their corresponding   histopathology   (Table 1)Out of 31 aspirates a specific cytologic diagnosis was possible in 27 cases (87.10%). In the remaining 4 cases only nonspecific diagnosis could be made.In 19 (95%) of the 20 benign lesions and 8 (72.73%) of the 11 malignant lesions a specific diagnosis was possible (Table II). Table III describes the specific cytologic diagnosis of 19 benign lesions already identified as benign in their FNAC and correlation with their histology. They were 9 cases of ameloblastoma,9 cases of infected cyst, and 1 case of giant cell granuloma. All the 9 smears from ameloblastomas showed a variable yet characteristic combination of basaloid and stellate or spindle cells in the aspirates. " Fig 1,2" The basaloid cells were usually arranged in small or large clusters with poorly defined individual cell borders and minimal to moderate amount of cytoplasm. Portions of the stromal elements with varying cellularity was seen along with inflammatory cells in 5 cases .No mitotic figures were observed   and the nuclei were not hyperchromatic. In 7 cases there was cent percent correlation between cytology and histology. But 2 cases diagnosed cytologically as ameloblastoma the histodiagnosis was calcifying epithelial odontogenic cyst with ameloblatomatous proliferation.

The smears from 9 cystic lesions were almost similar. They showed thick eosinophilic background and inflammatory cells . In 5 cases desquamated squamous cells were seen. In some cases large cells with abundant cytoplasm, pyknotic nuclei and many   anucleated squames were present. Multinucleated giant cells were seen in 2 cases. Histologically 8 of them were infected periapical cyst and 1 was infected dentigerous cyst. The smear of giant cell granuloma was moderately cellular with scattered giant cells, spindle cells and inflammatory cells. Spindle cells were characterized by basophilic cytoplasm and elongated nuclei with condensed chromatin. The multinucleated giant cells were characterized by abundant cytoplasm in which about 2 to 20 oval nuclei were present. "Fig 3". Histodiagnosis was in correlation with cytodiagnosis in this case. Table IV describes specific cytodiagnosis of 8 malignant lesions already identified as malignant in FNAC and their correlation with histology. They were one case of moderately differentiated carcinoma, 2 cases of well differentiated carcinoma, 1 case of poorly differentiated carcinoma, 2 cases of multiple myeloma, 1 case of chondrosarcoma and 1 case of adenoid cystic carcinoma.

Of the 4 squamous cell carcinomas diagnosed cytologically ,each case showed histologic correlation with respect cytodiagnosis. The smears of 2 well differentiated carcinoma were moderately cellular with squamous cells showing pleomorphism like spindle,oval and round shapes.The cytoplasm was highly eosinphilic and nuclei were small,round and less hyperchromatic. The smear of moderately differentiated squamous cell carcinoma showed numerous cells showing pleomorphism with abundant eosinophilic cytoplasm. "Fig 4". The cells had enlarged hyperchromatic nuclei in some areas and occasional multinucleated giant cells. Few cells showed abnormal mitotic figures. " Fig 5".The smear of poorly differentiated squamous cell carcinoma showed discrete atypical cells and small ovoid shaped cells with enlarged hyperchromatic nuclei. The large nuclei showed condensation of chromatin and a single prominent nucleolus. " Fig 6". The smears of 2 cases of multiple myeloma were almost similar. In one case the smear was highly cellular and the other was moderately cellular. Smear showed sheets of noncohesive round or oval cells with eosinophilic cytoplasm and eccentric round nuclei. Some double nucleated multinucleated and pleomorphic forms were also seen The smear of chondrosarcoma was moderately cellular. It showed round, oval or spindle cells with blue cytoplasm and

vesicular nuclei embedded in the cartilaginous matrix "Fig 7". The malignant cells had scanty cytoplasm. Nuclei were round or oval and hyperchromatic with occasional nucleoli. Mitotic figures were not seen. The chondroid matrix formed amorphous background with solid angulated fragments and it stained grayish blue with pap stain. Histodiagnosis was in agreement with cytodiagnosis. Smear of adenoid cystic carcinoma was moderately cellular and showed many clusters of cells which were round or ovoid with scanty cytoplasm and dark small nuclei. " Fig 8".The cytoplasm showed pale blue stain in pap smear. Thick mucin like material was seen adjacent to it with a light pink or gray stain. Histologic diagnosis was in correlation with cytodiagnosis.

Table V describes 4 cases grouped under nonspecific smears and correlation with their histology. 1 was a benign lesion and 3 were malignant lesions. The smear of round cell tumor was highly cellular with clusters of small round cells with scanty cytoplasm,slightly hyperchromatic nuclei and a few melanin pigments. Histologically the lesion was melanotic neuroectodermal tumor. Since the melanin pigment were few the lesion could not be diagnosed cytologically. The smear of spindle cell tumor showed spindle shaped cells in clusters with plump nuclei and mild atypia. The smear was insufficient to make a specific diagnosis. Histologically it was fibrohistiocytoma. 2 smears diagnosed cytologically as malignant lesions were moderately differentiated squamous cell carcinoma and metastatic carcinoma from breast histologically In the case of squamous cell carcinoma the smear was scanty and in the case of metastatic carcinoma the clinical data were insufficient.

Table I
Aspiration findings as per 35 cases and correlation with histology

Benign lesions n=20	%	Malignant lesions n=11	%	Inadequate cyto smears	%
Cytodiagnosis - 20	57.14	Cytodiagnosis - 11	31.44	4	11.42
Histodiagnosis 20	57.14	Histodiagnosis - 11	31.44		

Table II Distribution of 31 cytosmears based on specific diagnosis

	Benign lesions	%	Malignant lesions	%	Total	%
Specific Diagnosis	19	95	8	72.33	27	87.10
Nonspecific diagnosis	1	5	3	27.27	4	12.90
Total	20		11		31	

Table III Analysis of specific cytodiagnosis of 19 benign lesions and correlation with histology

Specific Cytodiagnosis	No	Histodiagnosis	No
Ameloblastoma	9	Ameloblastomas(2 cases calcifying epithelial odontogenic cyst)	7
Infected cyst	9	Infected cyst	9
Giant cell granuloma	1	Giant cell granuloma	1

Table IV Analysis of specific cytodiagnosis of 8 malignant lesions and correlation with histology

Specific cytodiagnosis	No	Histodiagnosis	No
Well differentiated squamous cell Ca	2	Well differentiated squamous cell Ca	2
Moderately differentiated Squamous cell Ca	1	Moderately differentiated squamous cell Ca	1
Poorly differentiated squamouscell Ca	1	Poorly differentiated squamouscell Ca	1
Myeloma	2	Myeloma	2
Chondro sarcoma	1	Chondro sarcoma	1
Adenoid cystic carcinoma	1	Adenoid cystic carcinoma	1

Table V Analysis of 4 cytosmears grouped under nonspecific diagnosis

Benign		Malignant	
Cyto diagnosis	Histodiagnosis	Cyto diagnosis	Histdiagnosis
1.Round cell tumor	Melanotic neuroectdermal tumor	1. Spindle cell tumor	Malignant fibrohistiocytoma
		2.Malignancy (scanty smear)	Moderately differentiated squamous cell Ca
		3.Malignancy	Metastatic carcinoma of breast

IV. Discussion

In the present study of the FNAC from 35 intraosseous lesions 20 were benign 11 were malignant and 4 were inadequate. There was 100 % accuracy in determining benignity and malignancies of tumors when correlated with clinical and roentgenographic features. Layfield et al[1] also reported an accuracy of 100% for FNAC in determining benignity and malignancy of primary bone lesions. According to different authors it is varied from 54% [2] to 100% [3]. The cytologic smears of various jaw bone lesions in the present study were quite characteristic and corresponded with histologic features in 87.1% of cases. This compares favourably with the diagnostic accuracy of needle aspiration reported by Khoury et al [2] that is 87.5%.Lowest accuracy rates were reported by Ramzy et al 65.21% [4] in jaw lesions and Layfield et al 66% [1] in other bone lesions. Highest accuracy rate was reported by Stoker et al [5] 97% in bone lesions and Goyal .S etal [6] 97.3% in jaw lesions. Layfield et al [1] reported that FNAC was not as efficient in the specific diagnosis of benign and malignant primary bone lesions. Specific diagnosis were often difficult because of the absence of characteristic architectural patterns. In this study a specific diagnosis was possible in 19(95%) of the 20 benign lesions and 8(72.73 %) of the 11 malignant lesions. Gunhan et al [7] reported specific cytodiagnosis in 12 (95%) of 15 malignant 69 (97%) of 87 benign lesions. Percentage of accuracy in specific diagnosis was greater in benign lesions in this study and Gunhan et al's study. In malignant lesions accuracy was less than that of Gunhan et al's report due to insufficiency of the material. Ayala and Zornosa [8] reported an accuracy of 83% in malignant tumors and 64.2% in benign tumors. Nazoora khan etal[9] reported an accuracy of 100% in malignant lesions and 73% in benign lesions. August M etal [10] also reported 100% accuracy in malignant lesions and 68% accuracy in benign lesions. The cytologic appearance of ameloblastomas in this study was similar to that reported by previous authors.[4,7,11,12,13,14] . According to Levine et al [11] the lack of cytologic features of any other tumor and similar morphology of histologic and cytologic preparations suggested diagnosis of ameloblastomas. Reports of many studies on FNAC of ameloblastoma and this study suggests the possible role of FNAC in diagnosis of these lesions. Ramzy et al [4] suggested that combination of basaloid,stellate and sometimes squamous cells is quite characteristic of ameloblastomas.

Cystic lesions (9 cases) in our study were more or less diagnosed accurately cytologically with the aid of clinical data and radiographs. But specific diagnosis was not possible. Findings of this study were in accord with that of previous reports of Ramzy [4] et al, Gunhan et al [7] and Timucin etal [15] . Ramzy et al stressed the importance of clinical history and radiologic appearance together with the cytologic appearance in arriving at a specific diagnosis.Gunhan et al[7] reported that in his series of the 31 cystic lesions ,all were diagnosed as epithelium lined benign cystic lesions. They could not be specifically diagnosed due to paucity of specific lesional cells . Our reports were in agreement with that of Gunhan et al.

Cytologic findings in giant cell granuloma was in accord with that of Ramzy [4] et al. They reported that the association of multinucleated giant cells with spindle stromal cells in a centrally located lesion was strongly suggestive of giant cell granuloma. However they reported that giant cells by themselves were not characteristic of any specific lesion of the jaw.Their association with other cell types, history and clinical features,whether lesion is multiple or solitary and metabolic status of the patient should be considered on arriving at a diagnosis. Gunhan et al [7] diagnosed 5 giant cell granulomas cytologically as giant cell containing proliferative lesions. In the present study there were 6 cases of squamous cell carcinoma. 2 were inadequate smears. In the remaining 4 cases cytodiagnosis was in comparison with different grades of histopathology. The cytologic findings of squamous cell carcinoma in this study were in accord with that of previous reports by Gunhan et al [7] Ramzy et al[4] and Das et al.[16]. Gunhan et al [7] reported 11 cases of squamous cell carcinoma in which one smear was insufficient and the remaining 10 cases were diagnosed accurately. Ramzy et al [4] repoted only one case of squamous cell carcinoma in which findings were in comparison with histodiagnosis. They reported that it showed features of malignancy and keratinization according to particular grade. The smears of 2 cases of multiple myeloma were diagnosed cytologically with the help of clinical data and roentgenograms. These reports were in accord with that of Layfield et al [1] and Kumar et al.[17] Kumar et al [17] reported 7cases of multiple myeloma which were all diagnosed cytologically. The cytofindings were in accord with that of histologic findings. He stressed that small cell tumors like Ewing's sarcoma, non-Hodgkin's lymphoma and multiple myeloma could be diagnosed correctly cytomorphologically.

The cytosmear of one case of chondrosarcoma in this study was also highly suggestive of it and was confirmed histologically. Cytologic findings was in accord with previous reports by Kumar et al[17],Olszewski et al [18], Layfield et al [1],Xiaojing and Xiangcheng [19] .Layfield et al reported 2 cases of chondrosarcoma showing similar cytofindings and was confirmed histologically.Kumar et al[17] reported 10 cases of chondrosarcoma which were confirmed histologically.Olszewski et al [18] evaluated cytofindings of 10 cases of chondrosarcoma and confirmed them histologically. He reported that aspirates of chondrosarcoma sometimes contained tumor cells strongly resembling malignant cells of epithelial origin. This is particularly true of signet ring cells of chondrosarcoma embedded in an amorphous mucin like material and of sheets of polygonal cells.

The cytosmear of one case of adenoid cystic carcinoma was more or less typically cellular and was also diagnosed cytologically. It was confirmed histologically. Similar reports were published by Qizilbash et al[20] and Das et al.[16]

A recurrent difficulty in most series was in obtaining sufficient material for diagnosis.[1,7,12,21] Many variables in technique may be important in determining the yield of diagnostic material. Needle diameter,number of punctures,number of vertical strokes, processing technique and experience of the aspirator. Some patients are poor candidates for aspiration biopsies since some lesions are either surrounded by intact cortical bone or the neoplasm itself is sparsely cellular and rich in calcified stroma. This problem was noted in sclerosing types of osteogenic sarcoma, fibrosarcoma, chondrosarcoma and ameloblastoma. Hence an open excisional biopsy in such cases was strongly indicated by many authors. [12,22]

In the series using large needles (2mm diameter) for bone lesions, inadequate material was obtained from 90%[23] to 26%[24].Series employing 1.25 mm diameter needle reported insufficient material of 18% [12] to31% [25] .Needles of 0.8mm to 0.6mm [2,3,26,27,28] reported insufficient material of 18%,8.6%,10%,14%, and 33% respectively. From these reports Layfield et al [1] concluded that needle diameter may be an isolated variable and does not seem to explain the difference in adequacy of diagnostic material.Series in which a single needle puncture was used in combination with numerous vertical strokes showed insufficient material in 18% [12],31% [25] and 33 %[28] of cases. The series employing multiple needle puncture with multiple strokes showed insufficient material in 8.2% [27],8.6%[2] and 16% [20]. Layfield [1] et al obtained a high yield of diagnostic material (100%) by using three needle punctures with repetitive vertical strokes until blood or tissue was seen in the hub of the syringe. He concluded from above observations that needle punctures per case may influence the yield of diagnostic material. In the present study aspirations were performed with 20 or 22 gauge needle with one puncture per case and 5-6 vertical strokes. Many workers have emphasized the role of aspiration cytology as an adjunct to histpathologic diagnosis.[12,19]

V. Conclusion

FNAC is a safe,rapid,cost effective and convenient procedure. An accuracy of 87.10% was observed with regard to specific diagnosis of jaw lesions studied here and it is found to be an effective procedure in differentiating benign and malignant lesions of the jaw bones. It provides helpful information and avoids hasty surgical biopsy in some cases. Greatest benefit of FNAC is its speed with which diagnosis is available with minimum expenditure, so that treatment planning can be instituted at the earliest. This is particularly true in recurrent tumours.
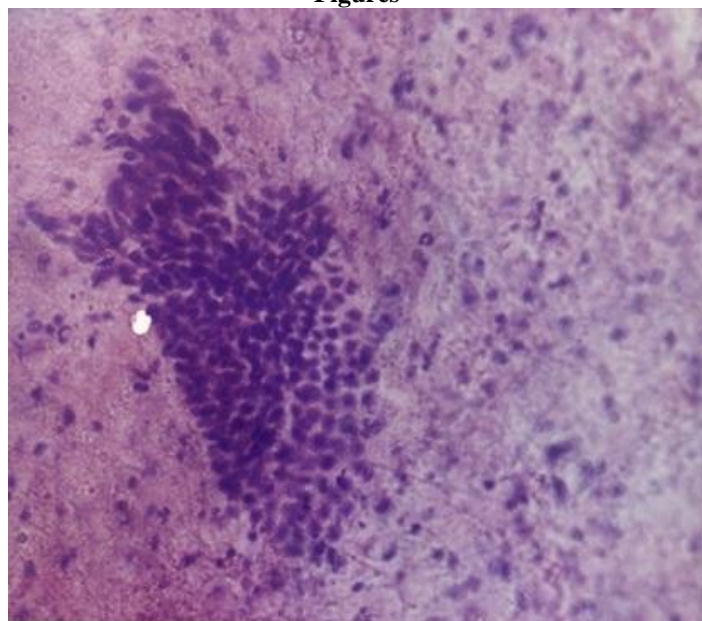
Acknowledgement

Figures

Fig 1. Smear of ameloblastoma showing clusters of basaloid and spindle cells. (x 400)
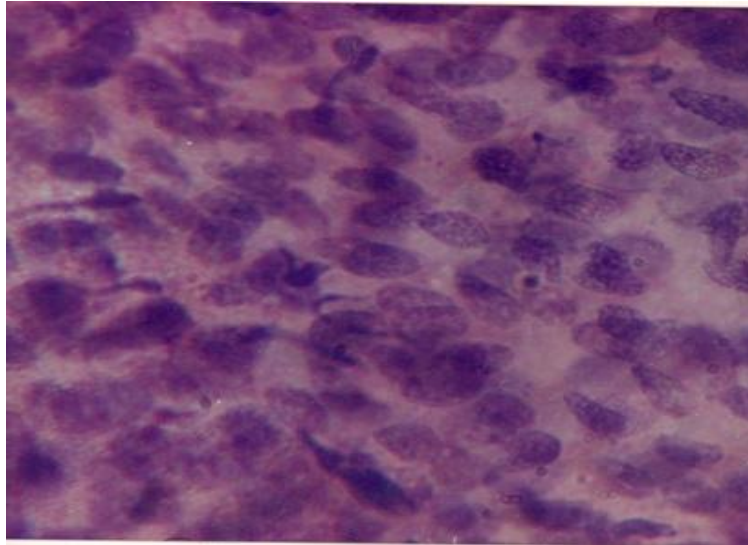
Fig3. Smear of ameloblastoma showing round or oval nuclei with coarsely granular chromatin and inconspicuous nucleoli. (x1000)
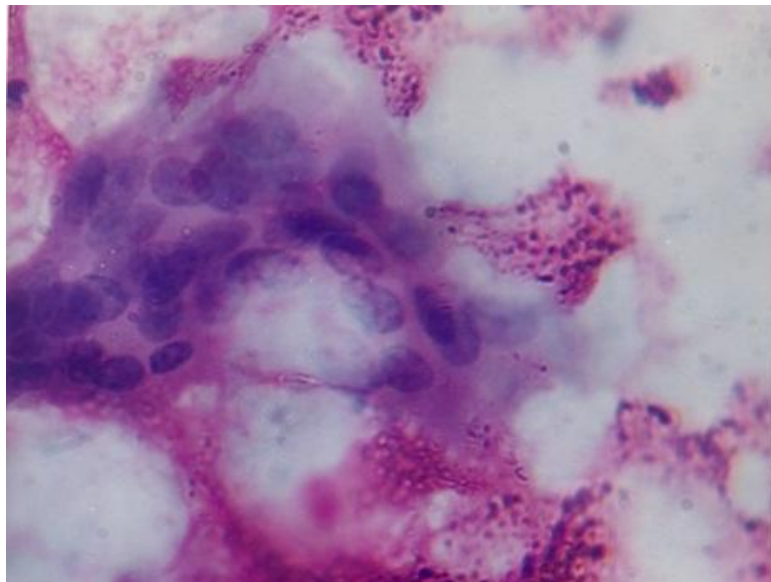

Fig 3. Multinucleated giant cell from smear of giant cell granuloma. (x1000)
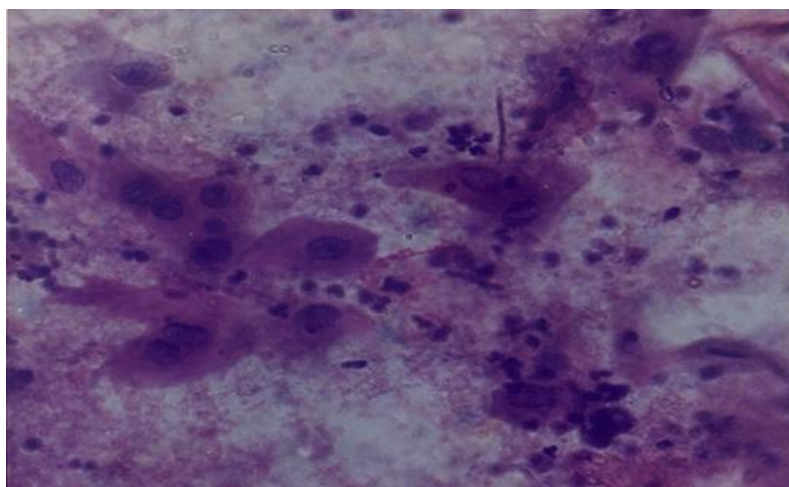

Fig 4. Smear of moderately differentiated carcinoma showing pleomorphic squamous cells with abundant cytoplasm and hyperchromatic nuclei.(x400)
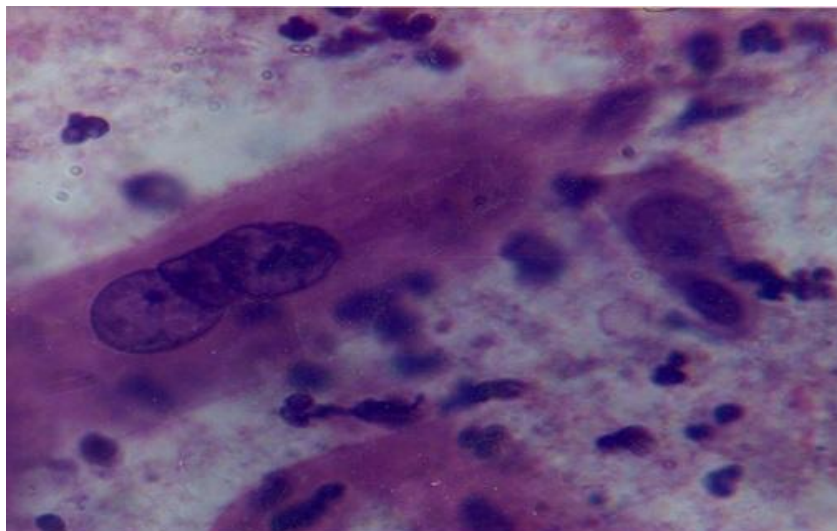
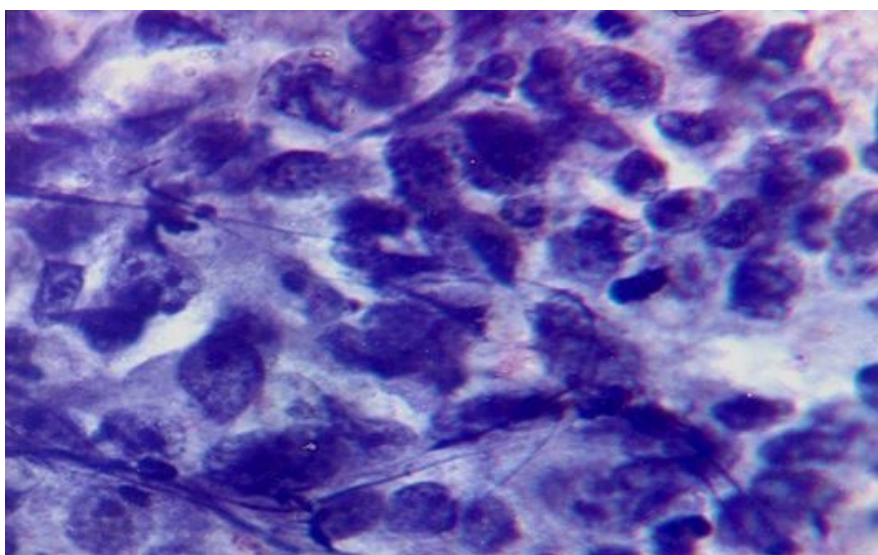**Fig 5.** Abnormal mitotic figure from cytosmear of moderately differentiated carcinoma .(x1000)

Fig 6. Cells of poorly differentiated carcinoma showing condensation of chromatin and a single prominent nucleoli.(x1000)
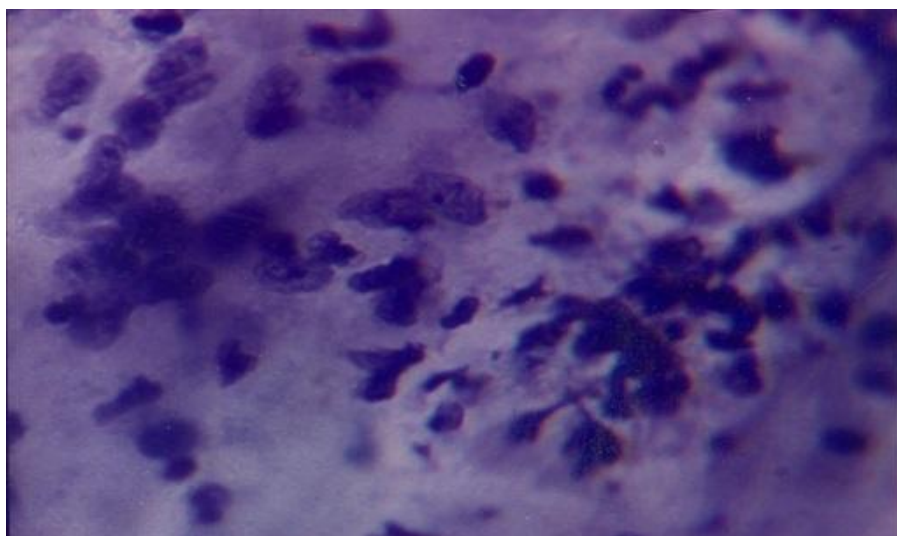

Fig 7. Smear of chondrosarcoma showing oval or spindle cells with hyperchromatic and vesicular nuclei embedded in the cartilaginous matrix. (x1000)
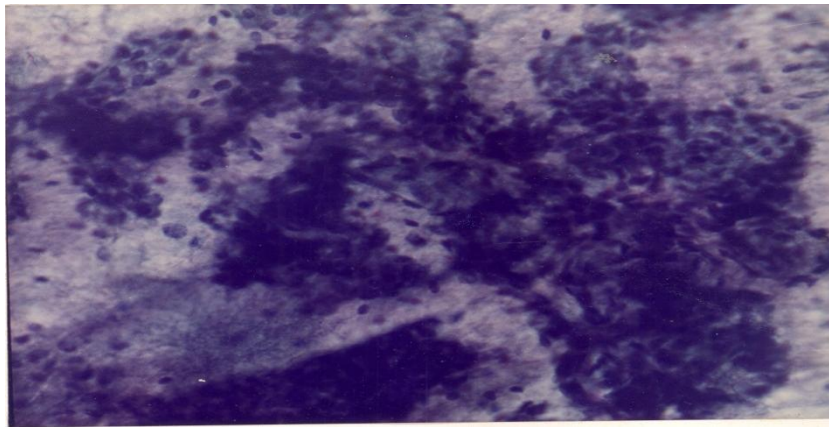
Fig 8. Cytosmear of adenoid cystic carcinoma showing clusters of small round or ovoid cells with scanty cytoplasm and dark nuclei. (x400)

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