ORIGINAL ARTICLE

Cytodiagnosis of Scalp Lesions

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ABSTRACT

Background: Scalp lesions being easily accessible for aspiration, fine-needle aspiration cytology (FNAC) offers a minimally invasive, rapid pre-operative diagnostic procedure, avoiding the hazards of open biopsy at this vital site. Benign entities in this region may mimic malignancy clinically and radiologically. FNAC helps to plan surgery, ruling out malignancy in the benign cases, and offering typing of the malignant ones.

Materials and Methods: A total of 80 palpable scalp nodules were studied regarding their clinical and cytomorphological features, and the value of FNAC in their differential diagnosis. 11 aspirates found inadequate for interpretation, were excluded from the study. FNAC was performed using a 23 gauge hypodermic needle. Air-dried smears were stained with May-Grunwald-Giemsa and wet fixed (95% ethanol) ones with hematoxylin and eosin and/or papanicoloeu stains. They were classified on cytology into inflammatory, non-neoplastic and neoplastic conditions. The neoplastic lesions were further typed as non-malignant and malignant, the malignancies as primary or secondary. Where possible, the origin of the secondary malignancy was suggested.

Results: There were 14 malignant and 55 non-malignant lesions. Non-malignant lesions included keratinous cysts, benign adnexal and mesenchymal tumors, meningioma, tuberculosis, cysticercosis and reactive lymphadenitis. Primary malignancies included osteosarcoma, primitive neuroectodermal tumor, and two squamous malignancies. There were four hematolymphoid malignancies. Metastatic lesions included four from follicular carcinoma thyroid, one each from an adenocarcinoma prostate and a retinoblastoma. Histopathologic diagnosis, available in seven cases, correlated with the cytodiagnosis.

Conclusion: FNAC offers rapid diagnosis in scalp lesions, ruling out malignancy in benign conditions and typing of the malignancies.

KEY WORDS: Fine needle aspiration cytology, scalp masses

Introduction

Scalp lesions are easily accessible for fine-needle aspiration biopsy (FNAB), which is vital in pre-operative diagnostic and therapeutic decision making, avoiding the hazards of open biopsy at this site.

Many benign entities at this site may mimic malignancy clinically, by virtue of large size, bony erosion and fixity. FNAB offers a rapid diagnosis in benign lesions of the scalp, ruling out malignancy. In the case of malignant lesions FNAB helps to diagnose and type the lesion, enabling the surgeon to plan the extent of surgery. The present study was carried out to study the utility of cytomorphology in diagnosis of lesions occurring at this site, differentiating benign lesions from malignant ones and typing of malignancies.[1]

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Materials and Methods

The present study was conducted over a 2 years period. Eighty patients with palpable scalp lesions constituted the study material. 11 aspirates were found inadequate for interpretation, and were excluded from the study.

The patients were evaluated clinically and radiologically for skull involvement. Computed tomography (CT) scan or ultrasonography (USG) was carried out when indicated, to assess the extent of the lesion and for intracranial extension. FNAB was carried out with a 23 gauge hypodermic needle, smears were prepared in the usual manner and stained by papanicoloeu and/or hematoxylin

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and eosin stain, after wet fixation; and by May-Grunwald-Giemsa, after air drying. In most cases, an unguided procedure was sufficient, but in some cases aspiration was carried out under USG or CT guidance. Lesions were broadly typed as inflammatory, non-neoplastic or neoplastic. Neoplastic lesions were further classified as benign or malignant. Typing of malignancy was offered, broadly as primary or secondary, further subtyping and the site of origin of the secondaries was suggested, where possible.

Ethics

These procedures were part of the diagnostic routines carried out everyday in the cytology section and were in accordance with institutional ethical standards.

Results

We studied 80 FNAB of palpable scalp lesions, both cutaneous and subcutaneous in location. There were 55 benign lesions, both neoplastic and non-neoplastic, and 14 malignant ones. The clinical and radiological details and the cytodiagnosis are tabulated (Tables 1-5).

The spectrum of benign lesions included inflammatory, cystic as well as neoplastic lesions (Table 1), the group comprising 30 females and 25 males with ages ranging from a few months to the eighth decade. The commonest lesions were keratin cysts (15 cases), which included epidermal and pilar or trichilemmal cysts, followed in frequency by lipoma (13 cases) and lymphadenitis (9 cases).

The keratinous cysts, epidermal and trichilemmal, were classed together.

However, it is possible to differentiate the two by the cytological findings (Table 4).[2] Calcification is said to favor a diagnosis of trichilemmal cyst. However, we have often seen calcification in, otherwise unequivocal, epidermal cysts on histology, probably because our patients tend to have longstanding lesions.

Among the inflammatory lesions, tuberculosis was reported in a human immunodeficiency virus-positive patient. No skull involvement was detected. Smears showed typical cytologic features, including caseation and granulomatous inflammation. Acid-fast bacilli were demonstrated by Ziehl–Nielson stain.

Benign soft tissue lesions included 13 lipomas, one dermatofibrosarcoma protuberans (DFSP) and one giant cell fibroblastoma. The DFSP was a recurrent lesion and was diagnosed as a fibrohistiocytic tumor of borderline malignancy. Smears showed discrete cells, as well as cells in groups, some exhibiting marked storiform pattern (Figure 1), with indistinct cytoplasm, oval to spindle nuclei, occasional multinucleate giant cell and collagenized stroma nuclear pleomorphism and mitotic activity were minimal. The giant cell fibroblastoma occurred in a child. Smears were moderately cellular, with plump

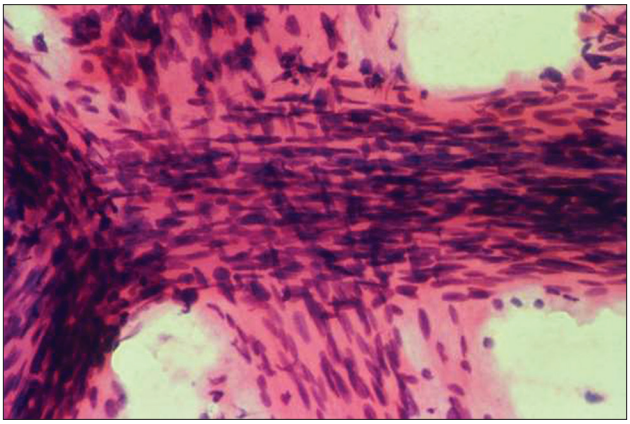

Figure 1: Dermatofibrosarcoma protuberans. Storiform pattern of spindle to oval cells (H and E, ×400)

Table 1: Cytological diagnosis of non-malignant lesions

Inflammatory lesions	No (%)	Cystic lesions	No (%)	Neoplastic lesions	No (%)
Lymphadenitis	9 (16.36)	Epidermal and trichilemmal cysts	15 (27.27)	Adnexal tumors	3 (5.45)
Non-specific (suppurative)	5 (9.09)	Non-specific cystic lesion	3 (5.45)	Lipoma	13 (23.64)
Tuberculosis	1 (1.81)			Other benign mesenchymal tumor	2 (3.64)
Cysticercosis	3 (5.45)			Other benign mesenchymal tumor	1 (1.82)

Table 2: Primary malignant scalp lesion

Age/sex	Site and size of lesion	Radiological features, other details	Cytolological features and cytodiagnosis	Histopathology
11 Years/Female	Frontopariatal 10×8 cm	Mainly soft tissue lesion. Outer table of skull showed erosion, no intra-cranial extension. Spiculated periosteal reaction	Pleomorphic, giant and spindle cells, necrosis, hyperchromatic nuclei. Metachromatic stroma. Pleomorphic sarcoma (? Osteogenic sarcoma)	Osteogenic sarcoma-chondroblastic type
12 Years/Female	Occipital, 7×7 cm	Bony erosion+, Peripheral smear and bone marrow were normal	Monomorphic small round cells, scanty cytoplasm. No rosettes. Primitive neuroectodermal tumor	Patient lost to follow-up
40 Years/Female	Pariato-occipital, 5×5 cm	Bony erosion+cervical lymph node+	SCC with secondaries in cervical lymph node	Well differentiated SCC
48 Years/Female	Pariatal region, 6×5 cm	Ulceroproliferative growth, no bony erosion	SCC	Moderately differentiated SCC

Table 3: Metastasis presenting as scalp lesion

Age/Sex	Primary malignancy	Site on scalp other findings	Cytologic diagnosis
40 Year/Female	Follicular carcinoma thyroid	Frontal swelling, 3 × 3 cm	Secondaries of follicular carcinoma thyroid
45 Year/Female	Adenocarcinoma prostate	Pariato-occipital region, bony erosion+, lytic lesion in T11 and L2	Secondaries of adenocarcinoma prostate
31/2 Year/Female	Retinoblastoma left eye	Right occipito-pariatal swelling, 5 × 5 cm	Secondaries of retinoblastoma
60 Year/Female	Follicular carcinoma thyroid	Frontal region, 6 × 5 cm, bony erosion and intracranial extention	Secondaries of follicular carcinoma thyroid
45 Year/Female	Follicular carcinoma thyroid	Temporal region, 3 × 3 cm	Secondaries of follicular carcinoma thyroid
51 Year/Female	Follicular carcinoma thyroid	Frontal region, 2 × 2 cm	Secondaries of follicular carcinoma thyroid

spindle cells, osteoclastic giant cells, and stromal fragments (Figure 2). The diagnosis was suggested by the age of the patient and the characteristic cytology.

The adnexal tumors showed moderately cellular smears, with groups and single cells and basement membrane material; cells had pale vesicular nuclei. These were lost to follow-up and could not be confirmed by histopathology.

The single case of meningioma was a 47-year-old female, with a left parietal scalp swelling and a history of head injury at the same site a year ago. The overlying skin was normal An X-ray skull revealed an expansile lytic lesion of the left parietal bone that eroded the outer table and had a considerable soft tissue component (Figure 3). Cytology smears revealed abundant cellularity comprising of sheets and loose syncytial clusters of spindly cells with occasional small tight whorls of cells (Figure 4). The cells were spindly, slender to plump, with pale cytoplasm. The nuclei were bland, oval to elongated, with finely granular chromatin. A few nuclei showed the presence of intranuclear pseudoinclusions that were sharply outlined. Occasional psammoma body was seen (Figure 5). The diagnosis was confirmed on histopathology as the fibroblastic meningioma.

Table 4: Hematolymphoid malignancies

Age/Sex	Site on scalp	Other investigations	Cytology	Histopathology
50 Year/Female	Occipital swelling, 10×10 cm, bony erosion+. Two punched out lesions in skull	Sr. Electrophoresis M-band seen. PS and BM WNL	Mature, immature and dysplastic plasma cells Plasmacytoma	Not done
55 Year/Female	Frontal swelling, 5×7 cm	PS and BM WNL	Granulocytic sarcoma	Patient lost to follow-up
57 Year/Female	Generalised nodular lesion with multiple scalp nodules, no bony erosion	PS shows atypical mononuclear cells	Cutaneous T-cell lymphoma	Mycosis fungoides
4 Year/Female	Occipital swelling, 3×3 cm, cervical LN+, no bony erosion	Tdt, Mic-2 and CD43+. CD10, CD3 negative	Non-Hodgkin's lymphoma	Lymphoblastic lymphoma B-cell type

Table 5: Differences between epidermal and pilar cysts

Features	Epidermal cyst	Pilar cyst
Background	Clean	Blotchy keratin or dirty, oily fluid
Cellularity and cellular appearance	High Singly dispersed nucleate and anucleate squames	Low Syncytial clusters of cells, occasional keratin globules
Oily, fluid debris	Scant to moderate	Present in older cysts
Keratin material	Keratin less than cells Plate like non- refringent Crystals. stains blue on MGG	Keratin more than cells Blotchy keratin Stains metachromatic Magenta on MGG
Calcification	Absent	Amorphous or as calcospherites

MGG: May-Grunwald-Giemsa

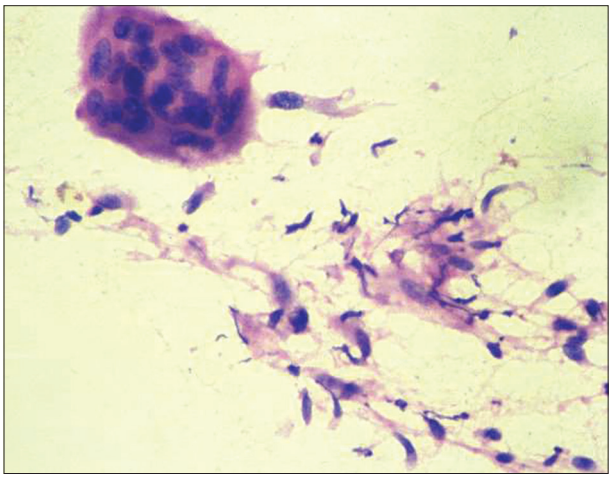

Figure 2: Giant cell fibroblastoma. Osteoclastic giant cell, cells with plump oval nuclei and wispy elongated cytoplasm (H and E, ×400)

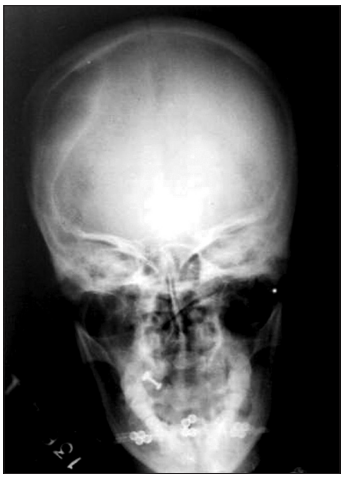

Figure 3: Meningioma. X-ray skull. Expansile lytic lesion in left parietal bone, eroding the outer table with a soft tissue component

Among the 17 pediatric patients (18 years and less) there was a predominance of inflammatory lesions, including the nonspecific lymphadenitis, suppurative lesions, and one cysticercus cellulosae. There were two epidermal cysts and one benign soft tissue tumor (giant cell fibroblastoma).

There were 14 malignant lesions, involving 10 females and four males, ages ranging from 3 to 60 year. There were four primary lesions, arising from scalp and underlying bone, six secondaries and four hematolymphoid malignancies. Histology was available in seven cases and was concordant with the cytodiagnosis.

Tables 2-4 show all relevant clinical features, radiological, cytological and histopathological findings in primary, metastatic and hematolymphoid malignancies of the scalp, respectively.

The pleomorphic malignancy with some foci showing metachromatic matrix (Figure 6), was diagnosed as pleomorphic sarcoma on cytology. It was subsequently diagnosed as parosteal osteosarcoma (OS). A complete examination of the rest of the body revealed no other primary focus. There was periosteal reaction seen on radiology. Therefore, this case was diagnosed as a primary parosteal OS of the skull. The case with small round cells and well-formed rosettes (Figure 7) was categorized as a primitive neuroectodermal tumor. Periodic acid Schiff's stain was noncontributory. The patient was lost to follow-up.

In the study period, in our laboratory, of all the metastatic sites in the body, the lymph node was the most common site for metastatic deposits (79.84%), followed by the liver (11.74%). Cutaneous/subcutaneous metastases were encountered in 38 of the 11,488 cases (5.24%), and the 6 cases with the scalp metastasis accounted for 15.78% of all subcutaneous/cutaneous metastases. The scalp as a metastatic site accounted for 0.83% of all metastatic sites, 3.84% of extranodal sites and 8.45% of all extranodal and extrahepatic sites.

Four cases of follicular carcinoma thyroid constituted the commonest metastatic lesion encountered in our study. There were syncytial groups and a few microfollicles in one of the aspirates from secondaries from thyroid (Figure 8). A monotonous population of follicular cells with bland nuclear morphology was seen forming sycitial clusters and microfollicles. In two cases, the scalp lesion was the first evidence of the disease. One case of

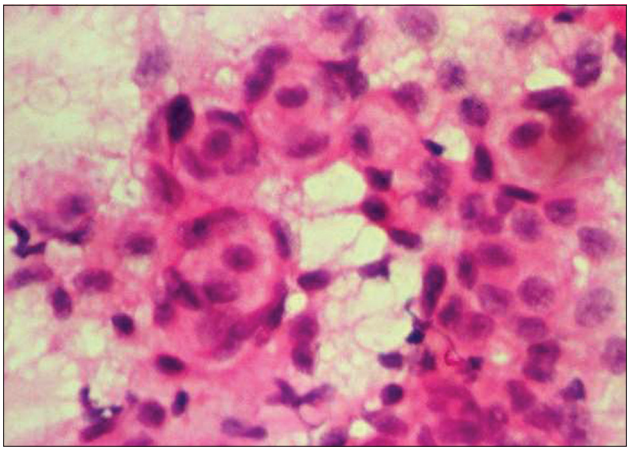

Figure 4: Meningioma. Syncytial clusters of cells with pale vesicular nuclei and prominent tight whirling (H and E, ×400)

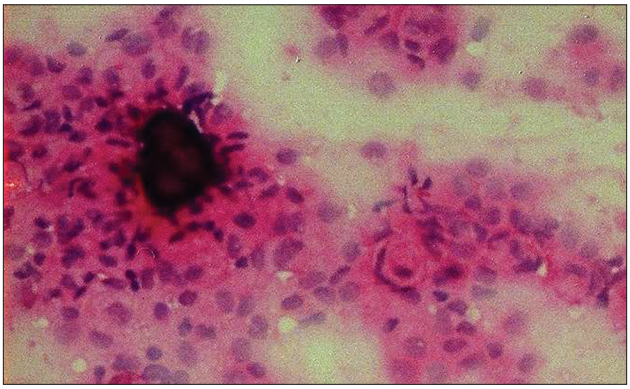

Figure 5: Meningioma. Psammoma body (H and E, ×400)

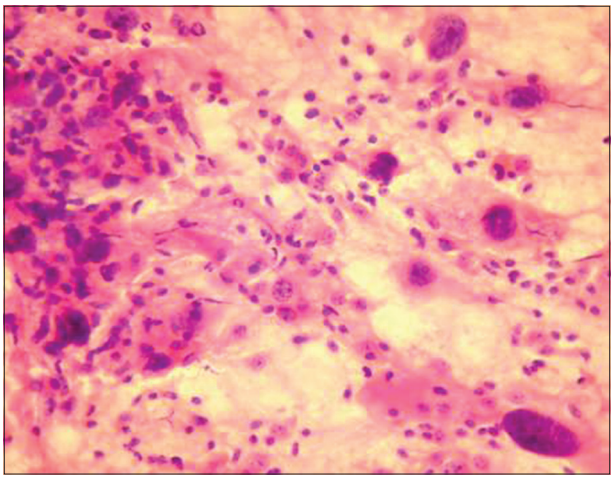

Figure 6: Osteosarcoma. Spindle and round cells, bizarre giant cells with prominent nucleoli and pink hyaline extracellular material (H and E, ×400)

retinoblastoma metastasis was seen in a known case with history of the lesion in the contralateral eye. The prostatic carcinoma metastasis was the first manifestation of the disease, the primary being suggested from cytological findings. The patient was found to have markedly raised levels of prostate specific antigen.

In the case of the 55-year-old female diagnosed as granulocytic sarcoma, the FNA smears showed features of granulocytic differentiation in the form of segmentation of nuclei and cytoplasmic granules, suggesting the diagnosis, which was then confirmed by a simple myeloperoxidase stain performed on the FNA smears. She was advised bone marrow studies, but these could not be carried out as the patient was lost to follow-up.

The smear from a patient with plasmacytoma showed both typical and atypical plasma cells, some of which were binucleate (Figure 9). M band was seen in serum electrophoresis.

The 4 years girl with B lymphoblastic lymphoma (B-LBL) has completed chemotherapy and on follow-up, she is well without any recurrences 5 years later.

In the 57-year-old female patient with generalized nodular skin lesions and multiple scalp nodules, FNAC smears showed monotonous cell population. Cells had scanty fragile cytoplasm with convoluted nuclei and inconspicuous nucleoli. A diagnosis of cutaneous T-cell lymphoma was suggested. Subsequent biopsy diagnosis was mycosis fungoides. Patient responded well to chemotherapy.

Discussion

FNA can provide a rapid and accurate typing of scalp lesions, especially useful due to their extremely easy accessibility. Various studies have established the utility of this technique in the management of these lesions.

Keratinous cysts, including epidermal and pilar cysts, were the commonest lesions diagnosed, which is similar to the findings of Garcia-Rojo *et al.*,[3] who found 16 trichilemmal cysts and eight lipomas in 62 scalp aspirates. A distinction between pilar and epidermal cysts is essential because of differing implications. Pilar cysts are often multiple and may progress to pilar tumors. They need wide excision as

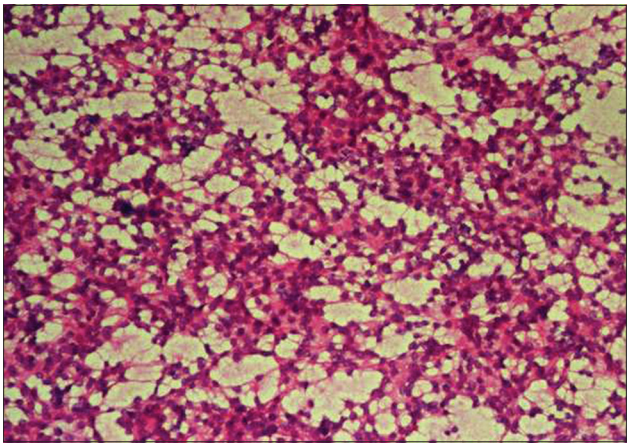

Figure 7: Primitive neuroectodermal tumor. Small cells with round nuclei, bland nuclear chromatin and a few rosettes (H and E, ×100)

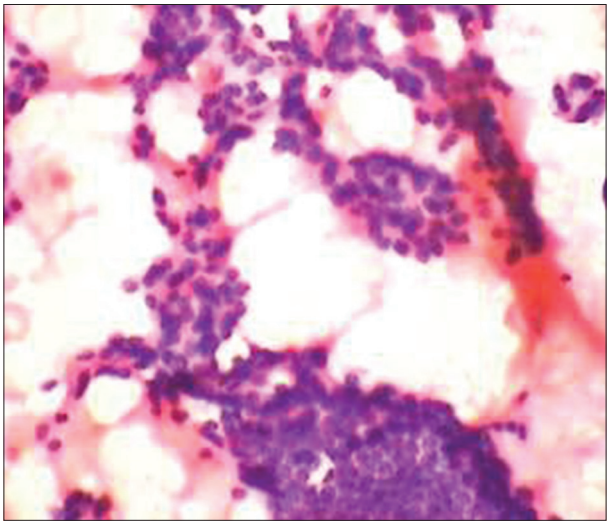

Figure 8: Metastasis from follicular carcinoma thyroid. Cellular smear showing syncytial clusters of small cells with nuclear crowding and numerous microfollicles (H and E, ×100)

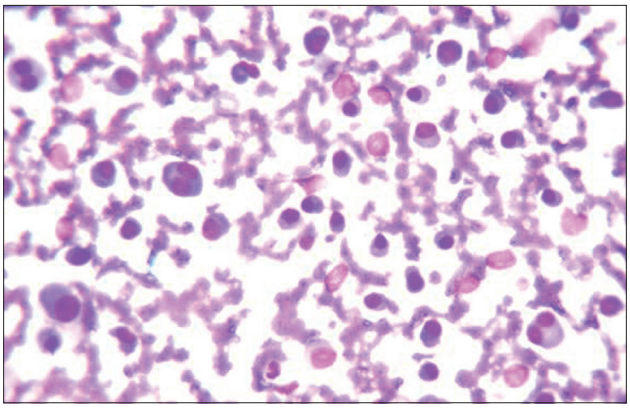

Figure 9: Plasmacytoma. Typical and atypical plasma cells with many binucleate forms (H and E, ×400)

they produce daughter cysts that may be left behind if excision is not adequate.[2]

Tuberculous lesion in the scalp has been reported secondary to calvarial involvement.[4-6] In cases where caseation is not too prominent, or absent, then sarcoidosis of the scalp should be considered in the differential as a very rare manifestation of cutaneous sarcoid.[7] Apart from lipomas, commonly seen at this site, diffuse neurofibromas are uncommon soft tissue tumors, occurring in the head and neck region of adolescents and young adults.[8] These should be properly evaluated for other stigmata of neurofibromatosis I or II.

DFP is more common in the limbs, but some authors have reported these in the head and neck as well. Sinha *et al*.[9] have presented a case in the scalp and described the surgical aspects of therapy. Their lesion was a recurrent one similar to ours.

Some adnexal tumors have been reported at this site in association with nevus sebaceous of the scalp (trichoblastomas and a syrigocystadenoma papilliferum).[10] Benign adnexal tumors should be kept in mind in the differential diagnosis of scalp masses, to avoid over diagnosis of malignancy.

Approximately, 1-2% of meningiomas arise at extradural sites with 68% of the primary extradural meningiomas involving the calvaria.[11] Head trauma has long been suspected as a risk factor with convincing documentation of meningiomas occurring in the immediate vicinity of a prior skull fracture.[12-14] Though still unclear, the pathogenesis postulated is that frequent mitotic activity as a part of the reparative process in the meningeal tissue captured in extradural tissue following trauma lead to changes promoting oncogenesis. Though hyperostosis is the most common radiologic finding (59%), osteolysis is seen in 35% of cases.

In our series, the most common lesions in pediatric patients were inflammatory. This is not in accordance with the findings of Cummings *et al*.,[15] whose series consisted primarily of keratinous cysts, developmental anomalies, and hamartomatomatous lesions.

Malignant lesions

FNAC is a useful and convenient method for diagnosis of malignant scalp lesions, with or without involvement of bone. This area is very vascular, and malignant tumors in this region quickly invade underlying bones and in advanced cases infiltrate brain parenchyma and its coverings.[1]

OS of the skull generally arises as a complication of Paget's disease, occurring in older patients than those with primary OS. Our patient was a child with no predisposing lesions in the skull. Similar cases were reported by Shinoda *et al*.[16] and Gupta *et al*.,[17] in a 26 years and a 19 years patient, respectively, with no predisposing lesions. These lesions have a poor prognosis. A rare case of cutaneous metastasis of OS to the scalp has been reported in a 46-year-old female with a history of OS in the knee.[18]

Squamous cell carcinoma (SCC) on the scalp could arise *de novo* or secondary to pre-existing lesions such as burns, scars, long-standing sores, sites previously exposed to X-rays or certain chemicals. In addition, chronic skin inflammation or chronic immunosuppressive states may encourage development of SCC, for example, actinic keratosis or radiotherapy for lesions like tinea capitis.[19] or as a complication of long-standing cutaneous lupus erythematosus.[20] In our case, however, it arose in a previously normal skin. SCC could also be metastasic from various sites.[21,22]

Cutaneous metastases of visceral malignancies are rare, and of these the scalp is a common site, probably due to its rich vascularity. Scalp secondaries may present as solitary or multiple nodules, erythematous papule or a bulging mass. A solitary nodule is most common. In the series of secondaries to various parts of the body by Saikia *et al*.,[23] lymph node metastases accounted for 77.2% (79.84 present study), cutaneous/subcutaneous for 5.6% (5.24 in this study). Scalp metastases formed 31.03 of cutaneous/subcutaneous metastases in their study, which was higher than in our study (15.78%). Scalp as a metastatic site formed 1.76% of all metastasis (vs. 0.83% in our study), 7.72% of all extra nodal sites (vs. 3.84% in our study) and 15.3% of all extra nodal and extrahepatic sites (vs. 8.45% in our study). In our study, five of the six cases of scalp metastases had primaries in the head and neck region. Follicular carcinoma of the thyroid accounted for 16.7% of metastatic deposits in the scalp in Saikia's[23] study. This figure is very high in our series (66.66 %). This is probably because of the small sample size. Cutaneous metastasis from thyroid cancer is rare. When they do occur, they are found in the head and neck area, particularly the scalp.[23]

The metastasis from prostate was osteolytic rather than osteoblastic. A similar case with multiple osteolytic metastases to the skull, simulating multiple myeloma, was reported by Maharaj *et al*.[24] Skin metastasis from visceral malignancies usually indicates a late stage and grave prognosis.

In cases of the granulocytic sarcoma, evidence of myeloid differentiation, in the form of segmentation of nuclei and cytoplasmic granules suggests the diagnosis, which can then be confirmed by simple tests like myeloperoxidase stain on cytological smears. Appropriate immunophenotyping can be done in centers where facilities are available. FNAB can reduce the need for surgical intervention when combined with immunophenotypic studies.[25,26]

Extramedullary plasmacytomas can occur anywhere and have to be differentiated from other lymphomas and infectious processes. FNAB is a frontline investigation in diagnosing extramedullary plasmacytoma.[27]

B-LBL are rare neoplasms but are commoner in children than in adults. In a series of six cases of this entity there were three in the scalp and the age range was 5-15 years.[28] Similar to our case, five patients in this series responded well to chemotherapy. Therefore, cutaneous B-LBL should be included in the differential diagnosis of small blue cell tumors in children and more particularly in females. In cases of malignant small round cell tumor, immunocytochemistry could make the correct diagnosis of difficult and controversial tumors possible.

In conclusion, FNAC of scalp lesions is a really useful, easy out-patient technique. Benign scalp tumors mimicking malignancy because of their large size, bone destruction and fixity to deeper structures, can be differentiated by aspiration cytology from malignant neoplasms. Identification of a lesion as metastatic or a hematolymphoid malignancy may be useful in avoiding unnecessary surgery. In other cases, the extent of surgery can be planned better. Thus, the information gathered from FNAC by a trained cytopathologist, having adequate knowledge of clinical oncology and tumor pathology, aided by radiological parameters, would be of great help to the neurosurgeons in excluding more sinister lesions, thus avoiding the hazards of open biopsy at this vascular site, and enabling meaningful surgical decisions to be taken.

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