

Histopathological Profile of Surgically Excised Scalp and Skull Lesions

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BACKGROUND/AIMS

Although subcutaneous lesions of the scalp are more common than those of the skull, few studies in literature have assessed the frequency of scalp and skull diseases. The goal of this study was to establish the frequency and main histopathological findings of these lesions. Our study is one of the largest series and shows that the incidence of surgically excised scalp masses includes an array of diseases.

MATERIAL and METHODS

We reviewed 265 extracranial masses from 173 patients. The mean age of the patients, gender distribution, localization and characteristics of lesions, histopathological type and radiological features were analyzed.

RESULTS

One-hundred (57.8%) patients were males and 73 (42.2%) were females. The mean age was 42.98 (range, 5-87). In total, 261 were within the scalp, 1 involved the scalp and skull and 3 were within the limits of the skull. Six lesions exhibited malignant features. There were 101 trichilemmal cysts; 74 epidermal cysts; 38 intradermal nevus; 8 verruca vulgaris; 5 squamous cell papilloma; 4 seborrheic keratosis; 4 capillary hemangioma; 3 compound nevus; 3 proliferating trichilemmal cyst; 2 blue nevus; 2 neurofibroma; 2 basal cell carcinoma; 2 langerhans cell histiocytosis; 2 fibrolipoma; 2 folliculitis decalvans and 1 case each of lipoma, dermoid cyst, pilomatricoma, cylindroma, nodular hidradenoma, apocrine cystadenoma, arteriovenous malformation, fibroepithelial polyp, folliculitis, malignant proliferating trichilemmal tumor, follicular carcinoma metastasis, fibrous dysplasia and inflamed fistula tract. No recurrence was seen except for 1 lesion.

CONCLUSION

Although the involvement of the skull is rare, scalp masses present a wide histopathologic spectrum of that arise in all ages. Overall, a majority of these lesions are benign and the presence of a malignant tumor or metastatic tumor presenting as a skull mass is less common. Lesions having intracranial/extracranial extensions may be treated with complete resection followed by skull reconstruction and a close follow-up is necessary.

Keywords: Scalp, skull, calvarium, excision, biopsy, histopathology

INTRODUCTION

The scalp covers the upper part of the calvarium bone that protects the brain (1). A wide assortment of pathology can be observed in the scalp and skull, which frequently presents as neoplastic, congenital, inflammatory and post-traumatic lesions (2). Trichilemmal cyst and epidermal cyst represent a big portion of tumoral lesions that cause a subcutaneous nodule in the scalp. The most common complaints are painless swelling, local pain and headache. These local swellings may be soft, medium, or hard (3). A histopathological confirmation of the excisional specimen should be performed for differential diagnosis. In symptomatic cases and the lesions causing aesthetic problems, surgical treatment is performed (4).

The exact incidence and the prevalence of scalp and skull lesions in adults or children are restricted. There is corresponding scarcity of data in literature concerning the clinicopathological practice of this site. Here, we aimed to present an overall framework to approach the diagnostic and clinical management of these patients. In this study, total excision with scalp and/or skull in 173 patients and 265 subcutaneous nodules were retrospectively examined.

MATERIAL and METHODS

We reviewed surgically excised scalp and skull specimens, presenting with a mass, were selected for this study. A total of 265 consecutive extracranial masses from 173 patients, including patients of all ages and both sexes, between November 2014 and December 2016 were included in the study. The data, such as the mean age of the patients, gender distribution, lesion localization, lesion characteristics, histopathological type and radiological features, were noted and analyzed.

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) Version 22.0 (IBM Corp.; Armonk, NY, USA) for Windows program. Descriptive statistics for the evaluation of results are presented in the form of mean, minimum and maximum values and numbers and percentages of the investigations. Because the study was conducted using patient reports in the archive of our laboratory, patient consent was not

required. The study protocol complied with the ethical principles of the Helsinki Declaration.

RESULTS

From a total of 173 patients with scalp and/or skull lesions, 265 lesions were excised (Table I). Seventy-three (42.2%) were females and 100 were males (57.8%; Table 2). In our review of 173 patients having nontraumatic masses on the head, patients had 28 different diagnoses (Table I). The age range of patients was 5-87 years and the average age was 43.3 years. Out of a total 173 cases, 16 occurred in individuals younger than 18 years of age.

All patients presented with a history of local swelling and subsequently underwent total resection in the surgical stage. Histological diagnostic specimens were taken from all resected material. The scalp was sutured primarily.

TABLE I. Histological diagnosis and age and sex distribution of the patients

Histopathological Diagnosis	Age (mean, years)		Sex		Total (lesions): 265 (%)
	Female	Male	Female (n=73)	Male (n=100)	
BENIGN LESIONS					
Trichilemmal cyst	51.9	40	34	31	101 (38.11)
Epidermal cyst	55.3	42.5	16	13	74 (27.92)
Intradermal nevus	30.8	32.3	13	20	38 (14.34)
Verruca vulgaris	30.5	35.7	2	6	8 (3.02)
Squamous cell papilloma	11	40.7	1	3	5 (1.89)
Seborrheic keratosis	0	59	0	4	4 (1.51)
Capillary hemangioma	0	38.3	0	4	4 (1.51)
Compound nevus	16	25.5	1	2	3 (1.13)
Proliferating trichilemmal cyst	39	42	2	1	3 (1.13)
Blue nevus	0	72.5	0	2	2 (0.75)
Neurofibroma	76	78	1	1	2 (0.75)
Fibrolipoma	0	41.5	0	2	2 (0.75)
Lipoma	0	52	0	1	1 (0.38)
Dermoid cyst	0	50	0	1	1 (0.38)
Pilomatricoma	0	49	0	1	1 (0.38)
Cylindroma	0	45	0	1	1 (0.38)
Nodular hidradenoma	49	0	1	0	1 (0.38)
Apocrine cystadenoma	0	42	0	1	1 (0.38)
Arteriovenous malformation	34	0	1	0	1 (0.38)
Fibroepithelial polyp	0	17	0	1	1 (0.38)
Folliculitis	0	42	0	1	1 (0.38)
Folliculitis decalvans	0	47	0	1	2 (0.75)
Inflamed fistula tract	0	45	0	1	1 (0.38)
Fibrous dysplasia	41	0	1	0	1 (0.38)
MALIGNANT LESIONS					
Malignant proliferating trichilemmal cyst	68	0	1	0	1 (0.38)
Follicular carcinoma metastasis	82	0	1	0	1 (0.38)
Langerhans cell histiocytosis	0	6.5	0	2	2 (0.75)
Basal cell carcinoma	0	56.5	0	2	2 (0.75)

Of the 265 lesions we reported, 261 lesions were within the scalp, 1 lesion (follicular carcinoma metastasis: 1) involved the scalp and skull. Three patients had lesions that involved the skull only [Langerhans cell histiocytosis (LCH): 2, fibrous dysplasia: 1], 3 had lesions that partly infiltrated the dura (Langerhans cell histiocytosis: 2, follicular carcinoma metastasis: 1); brain involvement was not seen (Table 3). The reconstruction of the skull defect was undertaken in 3 patients (LCH: 2, follicular carcinoma metastasis: 1) and they were referred to the oncology department for further treatment. Recurrence was observed in 1 patient (follicular carcinoma metastasis: 1) in 12 months of follow-up. Data on pathological diagnosis, incidence and location of scalp and/or skull lesions undergoing surgical intervention are presented in Table 1 and Table 3.

Most common pathologies were trichilemmal cyst (n=101, 38.1%), epidermal cyst (n=74, 27.9%), intradermal nevus (n=38, 14.3%) and verruca vulgaris (n=8, 3.01%).

Histopathological examinations of resection materials revealed benign lesions in 167 patients and malignant lesions in 6 patients.

Six patients had two diagnoses from two different lesions at the same operation.

One female had maximum lesions on her scalp with 29 epidermal cysts.

In children, subcutaneous masses involving the scalp and/or skull are rare and most of these masses are benign. No lesions recurred. The pathological diagnoses were LCH (2), intradermal nevus (4), squamous cell papilloma (2), verruca vulgaris (2), verruca vulgaris+fibroepithelial polyp (1), compound nevus (2), epidermal cyst (1), trichilemmal cyst (1) and pyogenic granuloma (1).

DISCUSSION

The incidence of malignant neoplasms of the scalp and skull is 0%-7.7%. A vast majority of them are actually thought to be met-

astatic rather than primary tumors, because the scalp is a common reservoir for metastatic tumors possibly because of its rich vascularity (5-7). The incidence of calvarial metastasis is 12.4% (8). Calvarial metastasis is seen in patients mostly with primary lung, breast, kidney and prostate neoplasms. Calvarial metastases are osteolytic or osteosclerotic lesions seen on direct radiographs. While primary malignancies occur in women, metastatic scalp and calvarial lesions occur in males (9). Wecht et al. (4) reported that the average age of male and female patients with malignancy in their studies was 37.8 years and 63.7 years. The primary malignant tumors of the scalp were proliferative trichilemmal tumor that was detected in a 68-year-old woman and basal cell carcinoma (BCC) in 2 cases in 55 and 58-year-old. Two eosinophilic granuloma were detected in the primary malignancies in calvarium in the present study. One follicular thyroid carcinoma case metastasizing to the cranium was encountered in an 83-year-old patient, which was operated via awake craniotomy and duraplasty methods. In the imaging examinations, the tumor invaded the calvarium, scalp and dura. The patient had no complaints in the postoperative period as the mass lesion was completely excised. The lesion measured 13.5 cm in the widest diameter. Relapse was detected after 1 year. Because of the fact that we are not a reference hospital for cancer, malignant lesions, especially metastatic tumors of the scalp and skull, may be found to be low.

Proliferating trichilemmal tumor (PTT) is a neoplasm that occurs as painless, single nodule in the hairy skin in older women. Histologically, there is still a debate in the definition of benign and malignant lesions. Some authors classify PTTs as benign, lowgrade malignant and highgrade malignant according to the stromal invasion, grade and cellular atypia level. PTTs are generally considered benign if they are well defined and have no cellular atypia. In addition to the pilar cyst feature, the histopathology of malignant proliferative trichilemmal tumor shows excessive epithelial proliferation, variable cytologic atypia, mitotic activity, atypical mitosis, nuclear polymorphism, adjacent invasion, and metastasis. These tumors may show malignant changes when they are benign.

When a malignant change occurs in the PTT, the lesion begins to grow rapidly and the cells acquire an atypical character. In the cases with PTT, the suggested evidence of malignancy lesions include diameter larger than 5 cm, rapid growth, invasion of surrounding tissues, prominent atypia in cells, high mitotic activity and severe dysplasia (10, 11). Our case with a 7.5 cm right occip-

TABLE 2. Demographic features of the patients

Variables	No of patients=173
Male	100 (57.8%)
Female	73 (42.2%)
Male:Female	1.3:1
Mean age, years	43.3

TABLE 3. Clinicopathological details of malignant scalp and skull lesions

Diagnosis	Age, years	Sex	Location	Presentation	Size	Recurrence	Dura mater extension
Basal cell carcinoma	55	Male	Scalp	Painless mass	1 cm	None	No
Basal cell carcinoma	58	Male	Scalp	Painless mass	1 cm	None	No
Langerhans cell histiocytosis	5	Male	Skull: Temporal	Swelling	2.2 cm	None	Yes
Langerhans cell histiocytosis	8	Male	Skull: Occipital and confluence sinuum	Swelling after minor head trauma	2.5 cm	None	Yes
Follicular Carcinoma metastasis	82	Female	Scalp+skull: Left parietal	Soft tissue swelling	12 cm	12 months	Yes
Malignant proliferating trichilemmal tumor	68	Female	Scalp: Right occipital	Soft tissue swelling	7.5 cm	None	No

ital mass was diagnosed as a lowgrade malignant, welldifferentiated PTT.

Most commonly, BCC is observed in the head and neck regions, which is nearly 85% of the tumors. Although exposure to ultraviolet light is the major causative agent in the etiology of BCC, non-exposed sites such as the scalp, may demonstrate a different pathogenesis in the development of BCC. In some patients, a history of previous radiation to the scalp for treatment is a risk factor for BCC (12). In the present study, 2 patients were males aged 55 and 58 years and had no history of radiation. Recurrence of these tumors was not identified.

Langerhans cell histiocytosis comprise 7%-10.8% of scalp masses in children (13). LCH was diagnosed in 2 patients. The cases presented with a swelling. In the cranial computed tomography (CT) examinations, a hyper-dense lesion in the occipital region above the confluens sinium was detected in 1 case. The lesions were 2.2-2.5 cm in size. Neutrophils, eosinophils, lymphocytes and plasma cells were observed in the microscopic examination of the mass in addition to diffuse infiltration of Langerhans cells with lobulated nucleus, thin chromatin, unclear nucleolus and eosinophilic cytoplasm in the curretted tissue. Lesions penetrated the dura partly in both cases. Patients were treated with complete surgical excision and no recurrences were identified.

Trichilemmal cyst is often found at the bottom of the hair follicle, which is thought to originate from the isthmus of the hair follicle. It is the most common cyst after the epidermoid cyst and is usually seen in middleaged patients with multiple lesions. Sau et al. (14) reported that the scalp was the most frequent localization site and that the female/male ratio was 2.5/1. In our study, trichilemmal cyst was the most common lesion found in the scalp lesions with incidence rate of 38.7% and the average age was 46.1 years. Consistent with the results of other studies, it was seen more frequently in women, and the ratio of female/male was 1.1/1. No recurrence was found in any of the patients in follow-up.

Epidermal cysts usually comprise epidermal elements that are implanted into the dermal layers. First, they should be differentiated from trichilemmal cysts by histopathological features (13).

Trichilemmal cysts show specific keratinization without a granular layer. In our study, with an incidence rate of 27.9%, epidermal cysts were found to be the second most frequently observed scalp lesion after trichilemmal cysts. The female/male ratio was 1.3/1.

In our study, with an incidence rate of 14.34%, intradermal nevus was the third common scalp lesion. It was more common in males with an average age of 32.3 years. Compound nevus is the clonal proliferation of melanocytes and is defined by its localization to both epidermis and dermis. Blue nevus may be observed at any age; however, they are more frequently first noted in children and young adults. It tends to have a predilection for the scalp, back of hands, buttocks and feet. The main differential diagnoses of blue nevus include pigmented dermatofibroma, pilomatricoma, and cavernous hemangioma. It may be due to an arrest in the embryonal migration of immature melanocytes in the dermis. A nodular proliferation of pigmented spindle and

dendritic melanocytes among the thickened collagen fibers is consistent with the diagnosis of blue nevus (15).

Verruca vulgaris, commonly called as a common wart, is one of the most recognizable skin growths and is a benign squamoproliferative lesion caused by human papilloma virus types 1, 2, and 4. Verruca vulgaris accounted for up to 3.01% (n=8) of scalp masses in our study. Of them, 6 patients were males and the average age was 35.7 years. We had 5 samples of squamous cell papilloma. Squamous cell papillomas with/without viral effect have not been reported in scalp and skull lesions in literature.

Seborrheic keratoses are usually multiple, light brown to black, oval, slightly elevated, sharply delimited papules or plaques and rarely greater than 3 cm in diameter. It is mainly seen in the back and thorax, but this lesion also occurs on the face, scalp, neck and extremities. Histologically, seborrheic keratosis shows hyperkeratosis, acanthosis and papillomatosis (16). To date, we could not find any report regarding seborrheic keratoses in scalp or skull masses. In our report, among the 173 patients, 4 male patients with seborrheic keratosis were described.

Hemangiomas can be seen in all age groups, but they most often peak in the fourth decade of life. The most common is the cavernous hemangioma. The incidence is 2.9% in children. Capillary hemangiomas are found in neuroimaging studies as vibrant improved, homogeneous soft tissue masses that are located outside the bone (13). The pathological diagnosis of the four lesions was capillary hemangioma (1.5%). One case had an arteriovenous malformation.

Fibrous dysplasia (FD) is a benign calvarial lesion. There are three types of FD: monocytic, polycytotypic and McCune Albright syndrome. Bone enlargement is responsible for symptoms and local swelling, visual loss, headache and cranial nerve paralysis may develop. In CT examinations, they are often homogeneous frosted glass (9). The reported incidence of fibrous dysplasia is 0%-6.2% of all scalp and skull masses. It mostly affects adolescents and young adults. The normal medullary space is replaced by fibrous connective tissue that leads to diploe expansion (13). We found one case of fibrous dysplasia of 10 cm in size in our study.

Lipomas comprise mature fatty tissue and form a soft, rounded to lobulated, movable mass against the overlying skin. Lipomas in the scalp occur at a frequency of 5%-14.5%. Erol et al. (9) reported lipomas as the most common benign lesion with a rate of 16.21% in the series of scalp and skull-localized neoplastic lesions of 37 cases. In another study, lipomas were assessed as the second most frequently observed scalp lesion with an incidence rate of 25.8% (17). It can be difficult to distinguish it from localized, overgrown with fat, rare adipocyte tumors. Fibrolipomas are a group of heterotropic lipomas of lipomatous tumors. We observed 1 case of lipoma and 2 cases of fibrolipoma in this series.

Nodular hidradenoma is a rare benign adnexal neoplasm classified into eccrine and apocrine types that are more often observed in adults. It is usually a small lesion, with a predilection for the neck, scalp, trunk and extremities. It appears as a single, slow-growing, well-circumscribed, unencapsulated, freely moving, solid-cystic, non-tender, dermal tumor, with a diameter of

0.5-12 cm. Cystic spaces may include eosinophilic hyaline material. Solid areas comprise clear and eosinophilic/polyhedral cells (18).

Other histopathological findings include proliferating trichilemmal cyst, neurofibroma, dermoid cyst, pilomatricoma, cylindroma, apocrine cystadenoma, fibroepithelial polyp, folliculitis, folliculitis decalvans and inflamed fistula tract.

Intracranial processes, such as a brain tumor or subdural infections, may manifest itself with scalp swelling. Direct radiographs, CT, magnetic resonance imaging (MRI) sequences, Ultrasonography (USG), CT-MRI angiography and their contrasted studies, and nuclear scintigraphic studies are used for the evaluation of scalp or skull masses to localize the lesion and exclude a possible intracranial extension. Pedunculated or midline scalp masses can be visualized using MRI to detect the grade of intracranial extension and any connection to the dural structures. MRI is preferred to characterize the appearance of scalp and soft tissue masses, while CT is a diagnostic tool for bony masses due to more bone selectivity. In the MRI scans of skull base malign tumors, nodular enhancement in the dura mater and dural thickness of more than 5 mm are the criteria for dura mater involvement (9, 13, 17).

In conclusion, various disorders may result in masses involving the scalp and skull. Scalp masses present a wide histopathologic spectrum that arise in all ages. Overall, the majority of these lesions are benign and the presence of a malignant tumor or metastatic tumor presenting as a skull mass is less common. Although intracranial extension is very low, neurosurgeons should be aware of the potential for intracranial extension of some masses. The possibility of recurrence is uncommon with early complete surgical resection. It is suggested that lesions having intracranial or extracranial extensions need to be treated with complete resection followed by skull reconstruction and a close follow-up is necessary. Excision materials should be histopathologically evaluated for a distinctive diagnosis.

Ethics Committee Approval: Authors declared that the research was conducted according to the principles of the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects" (amended in October 2013).

Informed Consent: Informed consent was not received due to the retrospective nature of the study.

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