

# Malignant Scalp Tumors: Retrospective Analysis of 1000 Patients.

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## Abstract

**Background:** Limited data on large cohort of patients with malignant tumors of the scalp are available in the literature. The aim of this study was to review a large cohort of patients with malignant scalp tumors to determine epidemiology, tumor characteristics of this region and treatment.

**Materials and Method:** A retrospective review of patients with malignant scalp tumors diagnosed histopathologically between 2005 and 2021 was performed. Demographic features and tumor characteristics were analyzed.

**Results:** A total of 1080 patients (M: F 3,5:1) were treated and followed up for a mean period of 42 months (12-120 months). Age at diagnosis ranged from 12 to 98 years. Most malignant scalp tumors (95,1%) occurred in those 50 years or older and in bald patients (87%). Basal cell carcinomas (59,2%), squamous cell carcinomas (32,2%) and melanomas were the most common histologic types. Incidence was highest on the frontal of temporal region (66,1%). Recurrence was frequently in squamous and basal cell carcinomas but uncommon in melanoma.

**Conclusions:** Tumors of the scalp accounted about 8,01 % of all skin cancers. Tend to be basal and squamous cell carcinomas, many of which occur in the temporal and frontal region of bald men. The outlook for patients with scalp tumor is positive, although we suggest excision margins of at least 3-4 mm and continued clinical vigilance is warranted given their higher recurrence rates.

**Keyword:** Scal Tumors, Integra, Skin Cancer, Epidemiology of Scalp Tumour

### Abbreviations:

SCC: Squamous Cell Carcinoma

BCC: Basal Cell Carcinoma

MLN: Melanoma

SSM: Superficial Spreading Melanoma

NCCN: National Comprehensive Cancer Network

AJCC: American Joint Committee on Cancer

## Introduction

According to the literature malignant tumors of the scalp represent approximately 1-2% of malignant tumors of the skin [1]. The most frequent cancers are basal cell and squamous cell carcinomas but also melanoma and many types of metastases may occur here. Although the relative low incidence several studies have shown that this region has important prognostic implications [1-8]. Known risk factors include advanced age, prolonged exposure to UV radiation, immunosuppression, premalignant lesions, trauma and history of radiation treatment [9-12]. Most scalp cancers are small in size and require outpatient surgical treatment. More rarely, scalp tumors infiltrate the skull, the dura madre, or the brain.

The authors report also patients with scalp tumor infiltrating bone and leptomeningis and their surgical treatment. Only few works are available in the literature and give conflicting data regarding the histological characteristics and demographic distribution. Between review a large cohort of patients with scalp malignancies, the authors achieve statistical data about tumor and patient demographics, especially surgical treatment with relative outcomes and prognostic factors.

The study was planned, approved and conducted according to the guidelines by the local ethical committee of the University Hospital of Palermo.

## Materials and Methods

We conducted a retrospective analysis on patients suffering from scalp's tumors which referred to the plastic and reconstructive surgery division of the University Hospital of Palermo in a 15-years period (from november 2005 to november 2021). All patients with benign and potentially malignant lesions of the scalp, and patient with genetic or familiar neoplastic syndroms were excluded.

Data obtained from the hospital's histopathology database and our medical records were the basis of this study. Available clinical data for each person included sex, age at diagnosis, presence of baldness, comorbidity, anatomic site of the tumor, surgical margins, reconstructive technique. Available pathology data comprised histologic type, morphology, tumor thickness, macroscopic and microscopic surgical margins.

We performed all surgical treatments according to hospital board guidelines and after jenuary 2012 according to NCCN guidelines (National Comprehensive Cancer Network) [13] Outcome parameters included recurrence, metastatic spread and survival. We divided scalp in five different subregions (frontal, temporal, parietal, occipital and vertex) to determine relative incidence of tumors according to sex, age and histological type.

All Patients had a maximum follow up of 120 months for patients with larger lesions (> 6 cm in diameter) and a minimum of 12 months for patients with small lesions (< 2 cm in diameter) (mean 42±7).

Statistical analysis was conducted using the software package SPSS version 20 for Macintosh. A Mann-Whitney test was selected to evaluate statistical significance of age at presentation. Pearson's chi-square test was used to evaluate statistical significance between patient. Data are Expressed in terms of the mean ± St Dev; p values less than 0:05 were Considered statistically significant.

Basal cells carcinoma, squamous cells carcinoma and melanoma were the most representative histologic types, other cancers accounted for less than 1 percent of all tumors and they were grouped together as "other" for the purpose of statistical analysis.

## Results

We retrospectively analyzed 13476 patients with skin lesions from 1th June 2005 to 1th September 2021 referring to division of plastic and reconstructive surgery, department of surgical, oncological and oral sciences of the University hospital of Palermo. Of these 1080 (8,01%) had a malignant tumor of the scalp, 809 were male (74,9 %) and 271 were female (25,1%). Age ranged from 12 to 98 (mean  $72,28 \pm 12,27$ ). The most frequent histological type was the basal cell carcinoma with 639 cases (59,2%) followed by squamous cell carcinoma with 348 cases (32,2%) and melanoma with 38 cases (3,5%). The soft tissue tumors, tumors of the skin appendages and metastases from secondary malignancies accounted for 55 cases (5,1 %).

Statistical analysis showed a higher incidence in male patients regardless histological types with a male: female ratio that varies from 1,92:1 (melanoma) to 4,89:1 (squamous cell carcinoma).

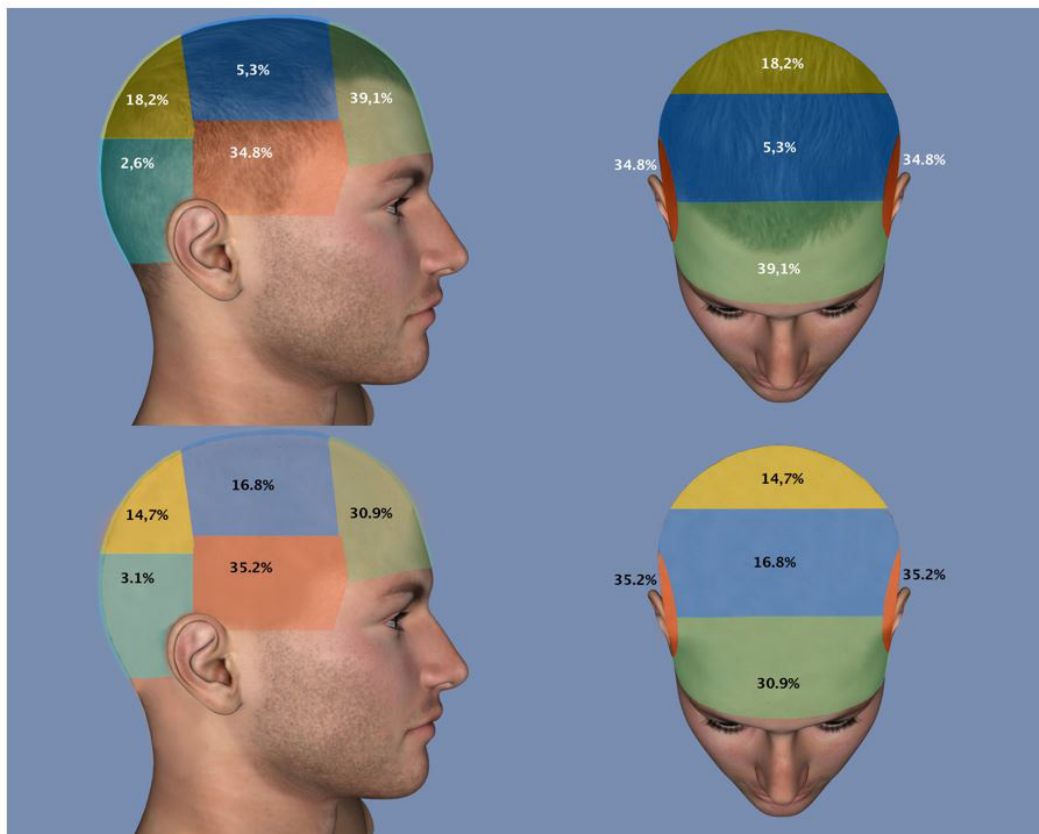
The average age of onset was  $72,56 \pm 0,41$  for male patients and  $71,41 \pm 0,82$  for female patients with scalp tumors. The different two groups were not statistically significant ( $p: 0,18$ ). (Table 1) 86,9% of male patients and 2% of women had baldness in tumor site.

Site	BCC,	SCC,	MLN,	Other,	Age, Mean		Recurrence	M:F
	n	n	n	n	Men	Women	n	
Frontal	227	88	7	12	71	70	37	234-100 2,3:1
Temporal	265	91	10	14	73	74	42	278-102 2,7:1
Parietal	119	28	8	26	70	72	28	137-44 3:1
Occipital	19	9	3	2	74	60	3	24-9 2,4:1
Vertex	9	132	10	1	77	70	18	136-16 8,5:1
Age (mean)	$73.91 \pm 10.38$	$78.58 \pm 8.69$	$69 \pm 9.7$	$72.59 \pm 15.83$				
M:F	2.9:1	4.89:1	1.92:1	2.2:1				
Total	639	348	38	55	$72,5 \pm 11,8$	$71,41 \pm 13,6$	128	809-271 2,3:1

According to age classes Basal cell carcinoma is more frequent in the 6th and 7th decades with a logarithmic distribution while squamous cell carcinoma occurs later usually between 7th and 8th decades. Regardless of the histologic type, there is an exponential growth with increasing of age with an asymptote at 8<sup>th</sup> decade.

The majority of the scalp lesions were located on the frontal and temporal regions. Together these accounted for 66,1% of all tumors. Figure I illustrated the distribution of primary scalp tumors in specific scalp's region. No significant differences were found for the localization of lesions between men and women.

In the balds patient temporal accounted for more than 35,2 percent of each malignancy type, frontal 30,9 percent, parietal 16,1 percent, vertex 14,7 percent, occipital 3,1 percent. In no-balds patient frontal 39,1%, temporal 34,8 %, vertex 18,2%, parietal 5,3%, occipital 2,6%. The anatomic distribution of male and female scalp tumors is depicted in Figure 1.



59.7% of patients (645 cases) presented a “T1” stage lesion at the time of diagnosis, 37.9% (409 cases) “T2”, 1.9% “T3” (21 cases) and 0.5% (5 cases) had a T4 lesions. Considering non – melanoma skin cancers (BCC and SCC) found it particularly in the frontal and temporal region and most of them were diagnosed at “T1” stage, while melanomas were ubiquitous with a slight predominance in the vertex and diagnosed at “T2” stage. However, melanomas were found also in stage “T3” and “T4” both at vertex and temporal region.

Noticeably, patients aged between 20-30 years were highlighted only melanomas at “T2” stage. Analyzing data related to SCC it was found that from 2th to 4th decades, the incidence of SCC is very low, amounting to 0.64% (2 cases), all lesions were “T1”. The incidence increases steadily with age with peak incidence between 7<sup>th</sup> and 8th decade (74,42% 259 cases). According to histological subtype, 75.1% (261 cases) were nodular type, 15.2% (53 cases) were ulcerated, 6.8% (24 cases) were “in situ” and 2.9% (10 cases) were infiltrating sub-type.

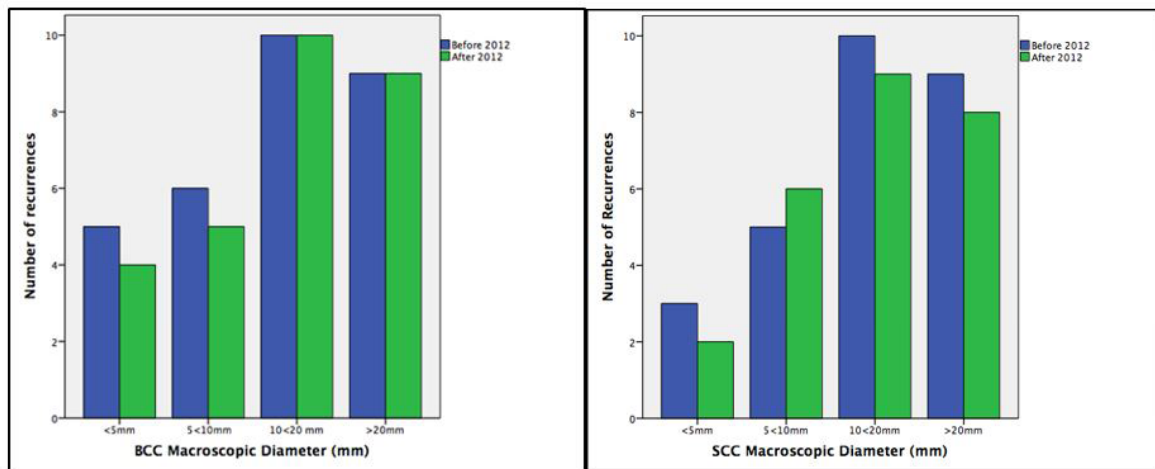
At the time of diagnosis 54,6% (190 cases) of squamous cell carcinomas had a T1 stage disease followed by “T2” 44,2% (154 cases), “T3” 0,9% (3 cases) and “T4” 0,3% (1 case); there were no statistical significance according to anatomical site p: 0.342.

We also analyzed the pathological lesions on the basis of the onset: synchronous or metachronous lesions (126 cases 13%) versus solitary lesions (845 cases 87%) these analyzes showed a high significance (p:0.01).

The basal and squamous cell carcinomas less than 2 cm in diameter were removed with surgical margins average of 3.1 mm in the period before 2012 and 3,9 after 2012. There were however no significant differences in the margins of the lesions of diameter greater than 2 cm in the two periods examined (average margins of 7.6 mm), so margins were respect the minimum recommended for each T stage, based on the NCCN guidelines [13].

All melanoma was treated according to current edition of AJCC staging system. Sentinel lymph node biopsy was performed in all cases with Breslow thickness  $\geq 0,75$  mm since 2000 and after 2010 also in cases with ulceration or with mitosis  $\geq 1/\text{mm}^2$ . after 2018 (8<sup>th</sup> edition of AJCC) sentinel node biopsy was performed in Melanoma with thickness  $>0.8$  mm or ulcerated (pT1b in AJCC).

Local recurrence was common in squamous cell carcinoma (n 52; 15%) and basal cell carcinoma (n 58; 9%) but rare in malignant melanoma (n 4; 1%). In other tumors category the recurrence was also common (n 14;25%), as showed in Figure 2.



Lymph node metastasis only occurred in patients with squamous cell carcinoma (n 19; 5,5%) and malignant melanoma (n 11; 28,5%). This involves the lateral cervical lymph nodes (n 23; 78%), parotid lymph nodes (n 4; 15%) or both (n 3; 7%). All patients with positive nodes underwent parotidectomy and radical laterocervical lymphadenectomy (I-V level). In cases of tumors of the vertex or occipital region, except in the cases with parotid sentinel lymph node, we performed just laterocervical lymphadenectomy.

Distant metastasis occurred just in 2 cases of malignant melanoma, both at T3 stages, and included disseminated cutaneous, lungs, brain and splenic metastases.

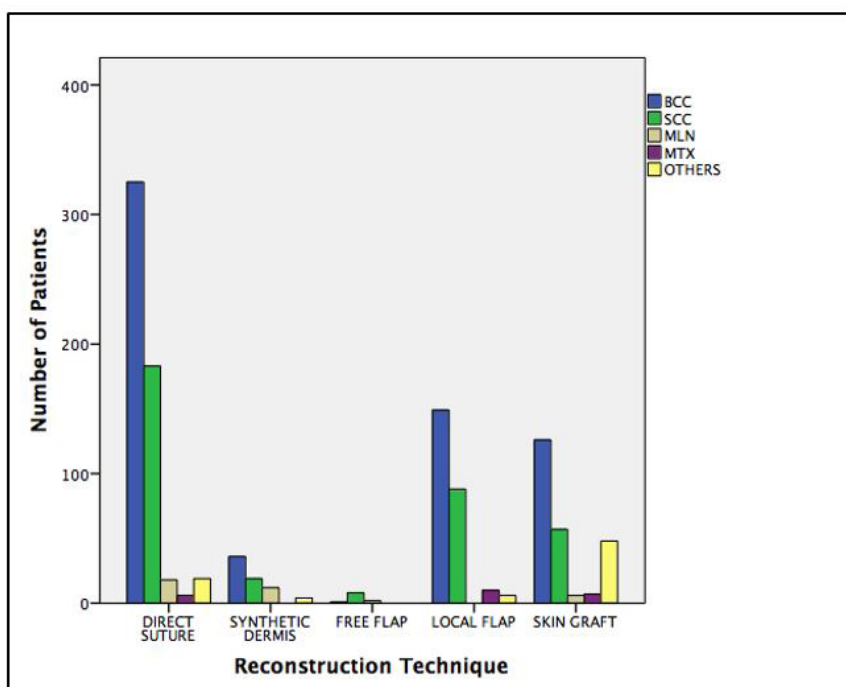
	BCC	SCC	MLN	MTX	OTHER
Follow up, mo Mean	37	40	45	12	20
Local recurrence no. of lesions rate	58 9 %	52 15%	4 10%	-	14 25,5%
Lymphonode metastasis no. of patients rate	-	19 5,4%	11 28,9%	-	-
In-transit metastasis No. of Patients Rate	-	19 5.4%	11 28.9%	-	-
Distant metastasis No. of Patients Rate	-	-	6 15,8%	-	-
5 years' survival Overall	100%	96,8%	74.4%	12,5%	100%
After metastasis	-	66,2%	39.2%	-	-
Bone Infiltration	50%	45%	-	-	-

**Table 2:** were described mean follow up, local recurrences, metastasis rates and %y survival

In our study we found 8 cases of metastases, primary tumors were melanoma (3 cases), followed by limphoma (2 cases), condrosarcoma (1 case), liver (1 case) and renal (1 case).

According to reconstruction type, in 48.3% (522 patients) tumors were removed and the loss of substance was closed by direct suture, in 23.6% (255 patients) by local flap, 20.7% (224 patients) placing a skin graft, in 6.5% (70 patients) by synthetic dermis and in 0.8% (9 patients) a microsurgical flap was used. In two of these patients the tumor infiltrated the skull and the dura mater. With neurosurgeons, the tumor was removed en bloc with the theca and the dura mater, while the loss of substance was covered with a patch of polymetrimethacrylate and a microsurgical free flap (latissimus dorsi and vastus lateralis). (Table 3) (Figure3).

	BCC	SCC	MLN	MTX	OTHER
No. of Primary closure	337	139	15	6	25
%	52,7%	39,9%	39,5%	75%	53,2%
No. of synthetic dermis	42	19	4	1	4
%	6,6%	5,4%	10,5%	12,5%	8,5%
No. of Free Flap	1	7	0	0	1
%	0,1%	2%	0,0%	0,0%	2,1%
No. of Local flap	153	90	2	0	10
%	23,9%	25,9%	5,3%	0,0%	21,3%
No. of Skin graft	106	93	17	1	7
%	16,6%	26,7%	44,7%	12,5%	14,9%
TOTAL	639	348	38	8	47
%	59,2%	32,2%	3,5%	0,7%	4,3%



**Figure 3:** Reconstruction by histological type. SCC, squamous cell carcinoma; BCC Basal cell carcinoma; MLN, Melanoma; MTX metastases

## Discussions

Cancers of the scalp are common in our area. According to our data, malignant tumors of the scalp accounted about 8,01 % of all skin cancers.

To our knowledge, there were only a few similar reports (Table 4) of scalp malignancies available in the literature and there has been no previously published study about large cohort on cancers of the scalp in Italian's patient. [2-4]. Furthermore, only one of these reports identify the location of scalp tumors and refer just to female cohort of patients.

We found that the majority of the malignant scalp tumors occurred in elderly male individuals (over 70 age), a finding consistent with previous reports.

There is a significant sex difference in the overall incidence (male: female = 3,31:1).

Over half the patients had a previous history of skin cancer, and one in three developed multiple scalp tumors. Patients with history of transplants had a lower age of onset and often had multiple scalp tumors, emphasizing the significance of immunosuppression as an important independent risk factor for skin cancer development [6,14,15,16]

Our results are in concurrence with prior reports showing an overall older age of presentation for BCC and SCC with mean age of presentation in the late seventh decade for men and women (mean age 72 years old) We demonstrated an higher incidence of melanoma and squamous cell carcinoma of the scalp respect previous studies, however in our dates basal cell carcinoma remain the most common histological type. (Table 4).

Series	Fong et al	Katz et al	Chiu et al	Current
Year	1986	2005	2006	2021
Country	Singapore	United States	Taiwan	Sicily
Ethnic group	Mainly Chinese	Not available	All Chinese	All Italian
Case n.	136 (patient No.)	178 (tumor No.)	398 (patien No.)	1080 (patient No.)
Data source (duration)	Singapore Cancer Registry (17 y)	Female scalp tumors treated with Mohs micrographic surgery (7y)	Chang Gung Memorial Hospital (21 y)	AOUP "P. Giaccone" Palermo (10 y)
Histologic Distribution (%; M: F; mean age at diagnosis)				
BCC	34.6%; N.I.; N.I.	85.4%; N.I.; N.I.	41.2%; 1:1,1; 59 aa	59,2%; 454-185 2,4:1; 71
SCC	53.7%; N.I.; N.I.	10.1%; N.I.; N.I.	16.6%; 1,3:1; 64 aa	32,2%; 289-59 4,9:1; 77
MLN	0; N.I.; N.I.	0.5%; N.I.; N.I.	2.0%; 1,7:1; 57 aa	3,5%; 25-13 1,9:1; 65
Skin Appendage T.	4.4%; N.I.; N.I.	1.1%; N.I.; N.I.	10.1%; 1,2:1; 58 aa	4,3%; 37-10 3,7:1; 67
MTX	N.I.; N.I.; N.I.	N.I.; N.I.; N.I.	12.8%; 1:1; 56 aa	0,7%; 5-3 1,7:1; 69

As our study is based on a Mediterranean population we believe that the discrepancy encountered data are probably due to different genetic and environmental influences of the populations studied.

While are not found significant differences in localization between men and women, differences were found between bald patients and not bald regardless of gender. This could be mainly due to the action of UV light, indicating a less important endocrine role.

Infact, the increased incidence of tumors in the sun-exposed sites (forehead and temple) emphasizing the significance of UV-injuries as an important independent risk factor for skin cancer development. Hair may be an important additional factor for cancer prevention, infact hair cover reduced solar Ultraviolet-B exposure by 81% compared with uncovered area [17]. In our data about 20% of melanoma patients had an age below 50 years but the average age of onset of melanoma was 70 years, similarly to the literature which indicates 62-63 years. [18]

Although the low incidence of melanomas of the scalp, several studies have shown that the involvement of this region has important prognostic implications. [8-19-20-21].

This study involved a period of 15 years during the guidelines were not uniform. As reported in Results section, after 2012 we started using broader margin according the NCCN guidelines for non-melanoma skin cancer. Most basal and squamous cell carcinomas 20 mm in diameter or less were excised with margin of 3,1 mm before 2012 and 3,9 mm after 2012, larger tumors instead with a margin of 7 mm, increasing to 10 mm for lesions of 30 mm or more in both periods.

We have not found significant differences (Figure 2), regarding the complete excision rate (96.2 percent) and recurrence rates (11.8 percent) between the two periods, probably because most tumors were basal cell carcinoma so 3mm are adequate margins according to many studies [22-23].

Furthermore, the larger lesions, which have the highest risk of recurrence, were treated keeping wide resection margins in both periods. This would seem to justify the application of the main guidelines for basal and squamous cell carcinoma excision margins for the same tumors in the scalp. Anyway we recommend keeping margins of at least 4 mm and the use of lower margins only for small nodular basal cell carcinomas. Maybe the high recurrence rate was partly due to poor diagnosis and many of the recurrences were new tumors insurgents near the scars of previously tumor excisions. Anyway close follow-up for these tumors is recommended (Table 2).

In our data the rate of recurrence and lymph node metastases does not change by location. However, we found that parotid lymph node metastases never occurred in cancer of the occipital region.

Though we have not seen a poor prognosis than melanoma with the same stage in other regions, a larger number of melanomas of the scalp had a T "3" and T "4" stage at diagnosis. Probably because melanomas appear initially as flat lesions that are difficult to see because hidden by hair. Patients also cannot self-examine their scalp totality so frequently they know the lesion only when someone else (hairdresser; family member etc) point it out.

The low frequency of other tumors prevented significant subanalysis regarding margins. However, we noticed high recurrence rates for some histological types. Especially in many cases of merkel cell carcinoma and eccrine carcinoma, it was necessary to perform multiple radicalizations with margins greater than 10 mm.

Though the analysis of the surgical treatment we could not draw up an algorithm for oncologic scalp reconstruction from our data. Erba et al. introduced the concept of "Reconstructive Matrix" that emphasizes choosing an optimal reconstructive strategy for a given combination of surgeon, patient, and reconstructive environment [24].

Apart from the patient's variables, many factors related to our different surgeons and surgical environment have been changed during 15 years. Reconstructions with dermal substitute for example was underestimated in our population. In fact it came into use in our department since 2007, so it refers to a series of just 8 years [28]. Also we noticed a gradual increase in the use of free flap during the years, perhaps parallel to raise in surgical skills. For these reasons, we could not provide guidance on the reconstructions. (Table 3)

However, interesting fact that the closure by first intention is always the most represented for locating in frontal and temporal region with statistical significant. This could be due to the fact that numerically our data are greatest for these two locations or maybe because the cancers are most visible so the earlier diagnosis. Furthermore in these regions, especially in elderly patients, the laxity of the skin and its redundancy would facilitate the primary closure of these defects. (Figure 3).

Wide resection with craniectomy and reconstruction with microvascular free tissue transfer provides safe and reliable treatment of invasive scalp skin cancers. In these cases the surgery was conducted by multidisciplinary and trained teams (plastic and neurosurgery), with good results.

Because not all patients with metastases to the scalp are treated surgically it is likely that our data underestimate the true incidence of secondary lesions in this region and the primary tumor's sites that we found confirming previously date [19,29,30].



## Conclusions

Tumors of the scalp accounted about 8,01 % of all skin cancers, tend to be basal and squamous cell carcinomas, many of which occur in the temporal and frontal region of bald men. Together these accounted for 66,1% of all scalp's tumors.

While are not found significant differences in localization between men and women, differences were found between bald patients and not bald regardless of gender. Therefore, the hair could have a role as a protective factor and demonstrate a hormonal secondary role.

The differences between patients bald and not bald, the higher incidence in bald patients, greater distribution on sun-exposed skin of the scalp and the elderly age of onset suggests that for basal and squamous cell carcinomas of the scalp chronic ultraviolet exposure play a relevant carcinogenic role, like confirming previously date.

The poor outcome of melanomas and the high incidence rate of other skin cancer in this region leads us to emphasize the importance of the inspection of the scalp in general screening of all patients.

Finally, according to current guidelines for non-melanoma skin cancers, we suggest excision margins of at least 3-4 mm also for non-melanoma skin cancers of the scalp and close follow-up for all patients with cancer higher than 20 mm in diameter given their higher recurrence rates.

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