



Scalp Tumors with Intracranial Extension in 50 Patients: Multidisciplinary Surgical Strategies and

Outcomes

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Introduction

Malignant skin cancers of the scalp can present with calvarial invasion, dural extension, and rarely intraparenchymal involvement. Typically such lesions involve a multi-disciplinary approach involving head and neck surgery, neurosurgery and plastic surgery for optimal resection and reconstruction.

No analysis to date delineates a systematic approach to the neurosurgical resection of these tumors and what impact aggressive resection may have on recurrence, complications, or survival.

Herein, we present a retrospective analysis of patients with scalp malignancies who underwent resection and reconstruction. To our knowledge, it is the largest case series describing scalp malignancies with intracranial extension requiring neurosurgical assistance. We also describe a grading system to assess the extent of neurosurgical resection and use this to stratify patients by risk of recurrence or complications and effect on survival.

Methods

Patients presenting with scalp malignancies (n=50) who required neurosurgical assistance for tumor resection were identified prospectively. Extent of neurosurgical resection was classified per Table 1. Evidence of local, locoregional, or regional recurrence was documented. Complications were assessed intra- and postoperatively up to the time of last follow-up.

Table 1. Grading scale – extent of neurosurgical resection and histopathology of scalp tumors.

Level	Anatomic Boundaries
I	Skin, connective tissue, galea, loose areolar tissue, pericranium
II a	Outer table of cranium
II b	Inner table of cranium
III	Dura
IV	Intradural and intraparenchymal tissue

Results

Patient demographics were collected as follows: sex (male, n=39; female, n=11), mean age at initial scalp tumor diagnosis (57.1), mean time in years from original diagnosis to time of neurosurgical intervention (4.1), prior history of tobacco use (52%), initial KPS (90.4), and last follow-up KPS (87.5). 22.5% of patients had metastatic disease to extra-regional (non-scalp) locations at the time of surgery.

Figure 1. Distribution of scalp tumors by location.

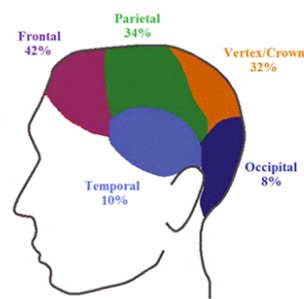


Table 3A. Tumor characteristics – histopathologic diagnosis.

Type	Number (%)
Squamous cell carcinoma	20 (40.0)
Basal cell carcinoma	8 (16.0)
Melanoma	8 (16.0)
Sarcoma	5 (10.0)
Atypical fibroxanthoma	3 (6.0)
MFH*	3 (6.0)
Other	3 (6.0)

*MFH - malignant fibrous histiocytoma

Table 3B. Tumor characteristics – years from diagnosis to surgery.

Type	Mean (years)
Basal cell carcinoma	10.5
Sarcoma	7.1
Melanoma	3.7
Squamous cell carcinoma	2.9
Other	2.5

Table 3C. Tumor characteristics – size of scalp mass.

Type	Number (%)
Less than 25 cm sq	25 (50.0)
25 to 75 cm sq	15 (30.0)
Greater than 75 cm sq	10 (20.0)

Table 4A. Summary of neurosurgical management.

Level of Resection	n (%)	LR [^] (%)	RR [^] (%)	LR R [^] (%)
I	3 (6.0)	1 (33.3)	1 (33.3)	1 (33.3)
II	38 (76.0)	11 (29.0)	8 (21.0)	14 (36.8)
III	7 (14.0)	2 (28.6)	1 (14.3)	2 (28.6)
IV	2 (4.0)	0 (0)	0 (0)	0 (0.0)
I, II	41 (82.0)	12 (29.3)	9 (22.0)	15 (36.6)
III, IV	9 (18)	2 (22.2)	1 (11.1)	2 (22.2)
Overall	50 (100)	14 (28)	10 (20.0)	17 (34.0)

[^] LR = local recurrence, RR = regional recurrence, LR R = locoregional recurrence

Level of Tumor	n (%)
I	50 (100.0)
II a	27 (52.0)
II b	12 (24.0)
III	9 (18.0)
IV	3 (6.0)

Table 4B. Overall survival and recurrence-free survival by tumor type

Treatment Modality	Number (%)	Disease-Free (%)
Surgery, XRT [^]	22 (44.0%)	14 (63.6)*
Surgery	15 (30.0)	10 (66.7)
Surgery, XRT, CTX [^]	12 (24.0)	7 (58.3)
Surgery, CTX	1 (2.0)	0 (0.0)

[^] XRT = radiation, CTX = chemotherapy; * = p < 0.05

Type	n	Follow-up	RFS [^]	Overall Survival
Basal cell carcinoma	8	3.2 Y	37.5%	87.5%
Melanoma	8	2.9 Y	62.5%	75.0%
Squamous cell carcinoma	20	1.2 Y	35.0%	65.0%
Sarcoma	5	2.1 Y	40.0%	60.0%

[^] RFS = recurrence-free survival

Surgery alone was not associated with a significantly increased chance of recurrence relative to surgery and radiation, however this was likely due to differences in their usage. Surgery alone was used primarily in cases where pathology was less severe (46% vs. 20%), however surgery with radiation or chemotherapy were used when the pathology was more severe. Documented metastases at the time of surgery demonstrated a trend toward significance with respect to locoregional recurrence (p=0.1921). There was no significant difference in complications based on level of resection (p=0.3768) or pathologic margins, although metastases at the time of surgery was a significant predictor of postoperative complications (p=<0.05).

There was no significant association between complication rate and cancer type, radiotherapy,

time from diagnosis to surgery, history of prior resections, or location of the lesion on the scalp.

Table 5. Overall post-operative complications (n=18).

Complications	Number (%)
Wound dehiscence or delayed healing	11 (61.1)
Infection	4 (22.2)
Respiratory distress/failure	3 (16.7)
Other	3 (16.7)
Encephalopathy	2 (11.1)

Table 6. Summary of reconstructive techniques.

Technique	Number (%)
Free flaps	45 (95.7)
Latissimus dorsi	28 (59.6)
Radial forearm	4 (8.5)
Anterolateral thigh	4 (8.5)
Rectus abdominis	3 (6.4)
Serratus anterior	2 (4.3)
Latissimus dorsi/serratus anterior	2 (4.3)
Anterolateral thigh/vastus lateralis	2 (4.3)
Adjacent tissue transfer	4 (8.5)
Split thickness skin grafting	44 (93.6)

Table 7. Summary of plastic surgery-related complications.

Complications	Number (%)
Recipient site	
Dehiscence	7 (14.9)
Delayed wound healing	3 (6.4)
Infection	2 (4.3)
Partial flap necrosis	1 (2.1)
Revisional procedures	7 (14.9)
Donor site	
Seroma	1 (2.1)
Hematoma	1 (2.1)
Delayed wound healing	1 (2.1)

Conclusions

Our study is the first attempt to classify the extent of neurosurgical resection for malignant scalp tumors and the largest series describing treatment of scalp malignancies with intracranial extension. This study demonstrates the efficacy of neurosurgical intervention, and that, despite aggressive resection, the incidence of complications is low.

References

See author for complete list of references.