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SURGICAL RESECTION OF TUMORS LOCATED IN THE INSULAR REGION

İNSULAR BÖLGE YERLEŞİMLİ KİTLELERİN CERRAHİ REZEKSİYONU

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SUMMARY

Introduction: *Only a few published surgical results of tumors in the insular region exist. The authors report their experience with tumors of the insula together with the surgical procedure and outcomes.*

Material and methods: *The authors studied 32 intrinsic insular tumor cases that underwent tumor resection in their department. Opercular retraction and the manipulation of the middle cerebral artery (MCA) and its segments were avoided by widely splitting the Sylvian fissure, dissecting the MCA, and identifying the important landmarks of the periinsular sulci. Tumor molecular pathology, location, achievable extent of resection, postoperative complications, postoperative neurological outcome, and overall survival were evaluated to determine the value of this surgical approach.*

Results: *12 tumors (37%) were purely insular, 11 (34%) extended into the temporal pole, and 9 (28%) extended into the frontal operculum. A transsylvian approach combined with a frontal operculum resection or temporal lobectomy was used. There were 17 patients with a tumor diameter larger than 5 cm. Gross total resection of the tumor was possible in 30 patients (93.7%). There was no postoperative death. Tumor recurrence developed in a single patient, after 5 years 2 months. The neurological condition improved after surgery in 15 patients but was unchanged in 12. Postoperatively, 1 patient had long-term dysphasia, 1 had aphasia, 1 had transient dysphasia and 2 had hemiparesis.*

Conclusion: *Widely splitting the Sylvian fissure and dissecting the MCA and lateral lenticulostriate artery (LLA) seems to be enviable method for total insular tumor resection without any deficit.*

ÖZ

Giriş: *İnsular bölgedeki tümörlerin cerrahi sonuçları ile ilgili sadece birkaç yayın mevcuttur. Yazarlar, cerrahi prosedür ve sonuçlar ile birlikte insula tümörleri ile ilgili deneyimlerini bildirmişlerdir.*

Gereç ve Yöntem: *Yazarlar bölümlerinde tümör rezeksiyonu yapılan 32 intrinsik insular tümör vakasını incelediler. Sylvian fissürün genişçe açılması, orta serebral arter (MCA)' in diseke edilmesi ve periinsular sulkusun önemli lendmarklarının ortaya konulmasıyla operküler retraksiyon ve MCA ve segmentlerinin manipülasyonu önlendi. Bu cerrahi yaklaşımın değerini belirlemek için tümör moleküler patolojisi, yerleşim yeri, ulaşılabilir rezeksiyon derecesi, ameliyat sonrası komplikasyonlar, ameliyat sonrası nörolojik sonuç ve genel sağkalım değerlendirildi.*

Bulgular: *12 tümör (% 37) tamamen insülerdi, 11 (% 34)'i temporal pole ve 9 (% 28)' u frontal operculuma uzanıyordu. Frontal operculum rezeksiyonu veya temporal lobektomi ile kombine transsilvian yaklaşım kullanıldı.*

Tümör çapı 5 cm'den büyük 17 hasta vardı. 30 hastada (% 93.7) tümör gross total rezeke edildi. Ameliyat sonrası exitus olmadı. 5 yıl 2 ay sonra tek bir hastada tümör nüksü gelişti. Ameliyat sonrası 15 hastada nörolojik durum düzeldi ancak 12 hastada değişmedi. Postoperatif 1 hastada uzun süreli disfazi, 1 hastada afazi, 1 hastada geçici disfazi ve 2 hastada hemiparezi görüldü.

Sonuç: *Sylvian fissürünün geniş açılması ve MCA ve lateral lentrikülostriat arterin (LLA) diseksiyonu, defisit geliştirmeden total insular tümör rezeksiyonu için en iyi yöntem gibi görünmektedir.*

INTRODUCTION

Low grade gliomas are both proliferative and diffusive tumors and require radical resection to prevent tumor progression and increase the recurrence-free interval (1,2). Recurrences usually progress to malignant disease, even after radical removal (3). Adding radiotherapy to partial removal has been associated with an unfavorable outcome due to a much higher incidence of recurrence and early malignant change compared to total removal and radiotherapy (3,4). Extension of low grade gliomas is centered on the insula, along the two main subcortical pathways of the uncinate fasciculus and the superior longitudinal fasciculus. A transsylvian approach has proven adequate to safely remove small lesions but the risk of induced postoperative neurological sequelae creates a serious problem when faced with large dominant lesions (3,4). We believe that an attempt should be made to achieve radical removal in every case.

In this retrospective study, we report the surgical results of 32 patients with insular tumors.

MATERIAL AND METHODS

A total of 32 insular tumor patients underwent surgery at our department between January 2000 and July 2018. A single lesion was present in each patient. The surgery was performed under general anesthesia in all patients. We prefer general anesthesia because it allows better control of the patient's airway and ventilation. Lesion removal started with the creation of a frontotemporal skin and temporalis muscle flap, followed by pterional craniotomy. After opening the dura, the Sylvian fissure was widely opened while taking care not to damage the superficial Sylvian veins. We avoided opercular retraction and manipulation of the MCA and its segments by widely splitting the Sylvian fissure, dissecting the MCA, and identifying the important landmarks of the periinsular sulci. We also avoided interrupting the lateral lenticulostriate arteries. We usually sacrificed the temporal branches of the superficial Sylvian vein while keeping the veins in the frontal area. Intraoperative histological examination of the resection borders is available and allows stepwise adaptation of the resection according to the histological results.

The middle cerebral artery and its branches were identified. We attempted to work between the frontal and temporal main branches of the middle cerebral artery. Tumor removal started with the slow coring out of the center and internal debulking. Intraoperative papaverine administration through the arteries helped avoid vasospasm. We support using postoperative radiotherapy in grade III and grade IV tumors. The degree of tumor resection was evaluated by serial MRI studies performed at 1 and 3 months postoperatively.

RESULTS

Complete resection was possible in 30 of the 32 cases (93.75%) while only subtotal resection was achieved in two patients (6.25%) (number 16 and 28) because the tumor had infiltrated the internal capsule and the lenticulostriate arteries. Tables 1 and 2 show the clinical characteristics of the patients whose age ranged from 18 to 77 years (mean 50.9 years). The male to female ratio was 1.46 (19/13). The two patients with subtotal resection required repeat surgery due to progressive growth of the tumoral remnants left behind at the first surgical procedure. One of these patients showed malignant change. We did not use needle biopsy. Tumor location was the right hemisphere in 17 (53.12%) cases and the left in 15 (46.8%). The transsylvian route using a surgical microscope was preferred in all cases. We attempted to preserve the superficial and deep venous systems during the Sylvian dissection. One patient developed persistent hemiparesis and another patient had motor dysphasia. Pathological reports were grade 1 glial tumor in 12 patients, grade 2 glial tumor in 4, grade 3 glial tumor in 4, grade 4 glial tumor in 7, ganglioglioma in 1, PNET in 2, and oligoastrocytoma in 2 patients. The tumor was histologically high grade malignant in 11 patients (34.3%) and low grade in 21 (65.7%). Patient age was under 40 years in 8 patients (25%). Preoperative epilepsy was present in 20 patients (63%) but 17 (85%) became seizure-free after tumor removal. Patients with high grade malignant tumors died within 1 to 5 years. Uncontrollable tumor progression led to death in 9 of the patients with a histopathological diagnosis of high grade glioma. No patient died within 30 days after surgery. Postoperative deficits consisted of hemiparesis in 2 patients, dyphasia in one patient, aphasia in one patient and transient dysphasia in one patient.

Radiotherapy was considered in patients histopathologically diagnosed with a high grade tumor.

Preoperative, postoperative images and the histopathological images of a patient operated for right temporal insular mass were shown (Figure 1, 2).

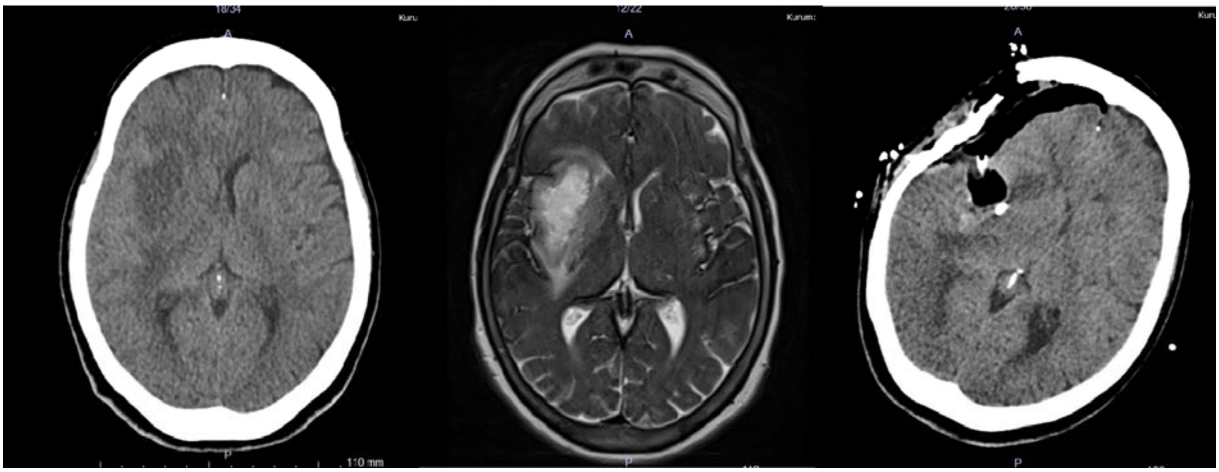

Figure 1. Preoperative axial CT -axial T2 weighted MR and postoperative axial CT of a right temporal insular mass.

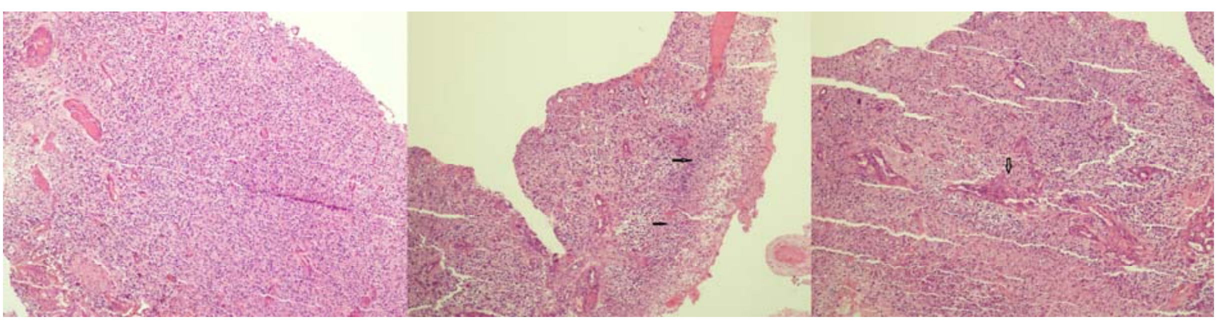

Figure 2. Histopathologic examination of the glial tumor with marked cellularity and vascularity (HEx100), pseudopalyzed necrosis area (HEx100), vascular endothelial hyperplasia area (HE x 100).

Table 1. The clinical characteristics, degree of the resection, histology, reoperation and postoperative deficits of the patients underwent insular tumor resection.

Number	Age	Sex	Degree of resection	Histology	Re-operation	Post-operative deficits
1	46	M	C	Grade 3 glial tm	-	none
2	36	F	C	gangliogliom	-	none
3	77	F	C	Grade 3 glial tm	-	none
4	40	M	C	Grade 1 glial tm	5y	disphasia
5	32	F	C	Grade 2 glial tm	-	none
6	55	M	C	Grade 4 glial tm	-	none
7	18	M	C	oligoastrositom	-	none
8	64	M	C	Grade 4 glial tm	-	none
9	67	M	C	Grade 1 glial tm	-	none
10	63	M	C	Grade 1 glial tm	-	none
11	52	F	C	Grade 1 glial tm	-	hemiparasy
12	29	M	C	PNET	-	none
13	58	F	C	Grade 4 glial tm	-	none
14	42	M	Subtotal	Grade 1 glial tm	-	hemiparasy
15	31	F	C	Grade 2 glial tm	-	none
16	70	F	C	Grade 4 glial tm	-	none
17	47	M	C	Grade 1 glial tm	-	none
18	56	M	C	Grade 1 glial tm	-	none
19	52	M	C	Grade 3 glial tm	28m	Aphasia
20	30	M	C	PNET	-	none
21	48	F	C	Grade 1 glial tm	-	none
22	52	M	C	Grade 2 glial tm	-	none
23	49	M	C	Grade 2 glial tm	-	none
24	44	F	C	Grade 1 glial tm	-	none
25	71	M	C	Grade 3 glial tm	-	none
26	50	F	Subtotal	oligoastrositom	2y	Motor dysphasia 1 week duration
27	60	F	C	Grade 4 glial tm	-	none
28	53	M	C	Grade 4 glial tm	-	none
29	24	F	C	Grade 1 glial tm	-	none
30	73	M	C	Grade 1 glial tm	-	none
31	40	F	C	Grade 4 glial tm	-	none
32	37	M	C	Grade 1 glial tm	-	none

Table 2: Adjuvant therapy, present situation, follow-up and malignization of the patients underwent insular tumor resection.

Number	Adjuvant therapy	Present situation	Follow-up	Malignization	Status
1	Radio	-	2y-7m	No	DEAD
2	No	Working	5y-2m	No	Alive
3	Radio	Normal life (NL) (independent)	5y	No	Alive
4	No	NL	5y-1m	No	Alive
5	No	NL	5y-2m	No	Alive
6	Radio	Living with assistance	5y-3m	No	Alive
7	No	Working	9y	No	Alive
8	Radio	-	2m	-	DEAD
9	No	NL	9y	No	Alive
10	No	NL	8y-6m	No	Alive
11	No	NL	8y-5m	No	Alive
12	No	NL	8y-7m	No	Alive
13	Radio	-	3y-4m	No	DEAD
14	No	NL	8y-1m	No	Alive
15	No	NL	8y-2m	No	Alive
16	Radio	-	2y-5m	No	DEAD
17	No	NL	8y-6m	No	Alive
18	No	NL	8y-3m	No	Alive
19	Radio	-	1y-8m	-	DEAD
20	No	working	4y-2m	No	Alive
21	No	working	4y-6m	No	Alive
22	No	NL	6y-4m	No	Alive
23	No	NL	6y-3	No	Alive
24	No	Living with assistance	4y	No	Alive
25	Radio	-	2y-6m	No	DEAD
26	No	working	3y-3m	No	Alive
27	Radio	-	3y 5m	-	DEAD
28	Radio	-	3y-2m	No	DEAD
29	No	NLI	6y-6m	No	Alive
30	No	NLI	6y-9m	No	Alive
31	Radio	-	4y	No	DEAD
32	No	working	5y-3m	No	Alive

DISCUSSION

The insular lobe is anatomically deep seated and is located close to vital structures such as the middle cerebral artery, internal capsule, and corresponding opercula (5,6). The middle cerebral artery supplies the insula with 100 to 125 branches (7-10). Preservation of the opercular arteries during insular surgery may be difficult but is vital. The veins can be sacrificed if needed but the even the small branches of arteries must be preserved. The highest risk of corticospinal tract damage is during removal of the medio-cranial tumor portions. Pre-operative multiplanar MR images and MR-angio studies are useful for surgical planning (11). Most of the tumoral lesions in the insular area are low grade and this rate was 65.7% in our series.

Total resection and meticulous surgery are very important in insular tumors. The insular lobe is not a separate anatomic and functional entity and cannot be separated from the limbic system and neocortex (12). Insular tumors extend within the insula and then to the operculum, followed by the paralimbic structures and later the limbic structures (13). Low grade gliomas are both proliferative and diffusive tumors. The tumor is rather bulky and its main locations are the supplementary motor area and the paralimbic system when proliferation is predominant, while diffusion occurs preferentially along the white matter tracts (2).

Advanced malignant tumors have a tendency to spare the adjacent neocortical and medial structures. These tumors can be approached and extirpated using the transsylvian approach and microneurosurgical technique (14).

Piepmeier et al. reported in 1996 that the most important variable in the survival of patients with low grade tumors was gross total resection, as it decreased the risk of recurrence.(5)

The 5-year survival rate of the patients with grade 1 and 2 tumors was 93.75% in this study.

Some studies have found no association between the extent of resection and the survival. Most analyses have also reported a residual tumor volume of less than 23 ml as providing a better outcome. We believe that radical resection decreases the recurrence rate in low grade tumors. The follow-up duration for patients with low grade glioma was 5-10 years in our series.Low grade gliomas are not benign neoplasms, since they systematically change their biological nature and evolve to high grade gliomas with a median delay of anaplastic transformation around 7-8 years, becoming invariably fatal (median overall survival around 10 years) (5,15-19).

In our series of 32 patients, we postoperatively encountered permanent mild hemiparesis in 2 patients with grade 1 glial tumor, minimal dysphasia in 1 patient with a grade 1 glial tumor, aphasia in 1 patient with a grade 3 glial tumor, and transient dysphasia in 1 patient with an oligoastrocytoma. There were 11 patients in the high grade group in our series and all were referred for radiation therapy.

CONCLUSION

Radical resection in insular tumors decreases the recurrence rate and provides a better outcome. Radical surgical intervention is superior to other treatment modalities in this area. The best method consists of total resection of insular tumors without creating a deficit after widely splitting the Sylvian fissure, and dissecting the MCA and lateral lenticulostriate artery.

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