ORIGINAL ARTICLE

Effectiveness of Open Surgery for Supratentorial Gliomas in Terms of Improvement in Karnofsky Performance Score

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ABSTRACT

Introduction: *Glioma is a primary brain tumor derived from neuralgia cells like astrocytes, oligodendrocytes and ependymal cells. It is a non curable malignant tumor. Therefore, the objective of the treatment is mainly to improve quality of life.*

Objective: *To determine the effectiveness of open surgery for supra-tentorial glioma in terms of improvement in Karnofsky performance score.*

Materials and Method: *This Descriptive case series study was conducted at Neurosurgery Department PGMI / LRH Peshawar from January 2012 to December 2012 (1 year). Total 144 consecutive patients with supra-tentorial glioma of more than 18 years of age who underwent open surgery (craniotomy with tumor resection) were included. Pre and postoperative Karnofsky performance score was recorded.*

Results: *Total of 144 patients were included in the study, of which 101 were males and 43 females. Age ranged from 19 years to 65 years with 36.8% of the patients in the 3rd decade of life. Majority of the patients had supra-tentorial glioma in the frontal lobe making 38.9% of the whole. In 63.9% of the patients, the procedure was effective. It was more effective in young individuals as compared to patients of middle and old age. Furthermore, the success rate was more in patients with frontal lobe tumor followed by those with parietal glioma.*

Conclusion: *Open surgery with total or partial resection of tumor is an effective procedure for the treatment of supra-tentorial glioma. Its effectiveness is influenced by the age of patient, location of the tumor and preoperative Karnofsky performance score.*

Key Words: *Open surgery, supra-tentorial glioma, effectiveness.*

INTRODUCTION

Primary malignant brain tumors account for approximately 2% of all cancers in US adults. Glioma is a primary brain tumor derived from neuroglial cells like astrocytes, oligodendrocytes and ependymal cells. It accounts for more than 80% of primary brain tumors.[1] Peak incidence occurs between 35 and 44 years with increased prevalence among white people and men.[2]

Gliomas are divided into 4 grades. Grade 1 and 2 are low grade, where as grade 3 and 4 tumors are high grade based on cellular origin and histological appearance.[1] High grade gliomas are generally aggressive tumors with poor prognosis. They tend to recur locally and rarely spread beyond the confines of central nervous system. Therefore, local control is considered the primary determinant of overall survival.[3]

Glioma is a common problem that we encounter in our population. It is a non curable malignant tumor. Therefore, the objective of the treatment is mainly to improve quality of life. Several prognostic factors have been identified in patients with malignant glioma including age, performance status, location of tumor, histological grade and extent of resection. Performance status rather than histological grade is the key prognostic factor in elderly patients with supratentorial malignant glioma. Therefore, elderly patients with a

good preoperative Karnofsky performance score can be treated aggressively with extensive resection and radiotherapy.[4]

Chemotherapy as the only adjuvant therapy has not been advocated for the elderly because malignant gliomas are chemoresistant[5]. However, temozolomide, a novel alkylating agent, has shown modest activity against recurrent glioma but the two years over all survival estimate for Glioblastoma multiform is still disappointing (27%).[3,4]

MATERIAL AND METHODS

This Descriptive case series study was conducted in neurosurgery department, Lady Reading Hospital, Peshawar from January 2012 to December 2012 (1 year). All patients with supratentorial glioma of any grade with age > than 18 years and baseline karnofsky score of 20 and above were included in the study. Those patients with recurrent glioma, brain stem and optic nerve glioma, Gliomas extending to the infratentorial region and those crossing the midline, Intra-ventricular glioma and patients with serious co morbidities (heart and chest diseases) affecting Karnofsky performance score were excluded from the study.

After taking approval from the hospital ethical committee, Consent was taken from the patients or their relatives. All patients were subjected to detailed history followed by complete physical and neurological examinations and routine set of investigations. The enrolled patients were put on the OT list after 4 – 5 days, ensuring blood arrangement and anaesthesia assessment through an expert anaesthesiologist. On the OT day, open surgery (craniotomy with partial or gross total resection of tumor) was performed under general anaesthesia by expert neurosurgeons.

Table 1: *Gender Distribution.*

Sex	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Male	101	70.1	70.1	70.1
Female	43	29.9	29.9	100
Total	144	100	100	100

Table 2: *Age Distribution.*

Age Range (in Years)		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	19, 20	9	6.3	6.3	6.3
	21 – 30	53	36.8	36.8	43.1
	31 – 40	19	13.2	13.2	56.3
	41 – 50	24	16.7	16.7	72.9
	51 – 60	34	23.6	23.6	96.5
	> 60	5	3.5	3.5	100.0
	Total	144	100.0	100.0	

Table 3: *Disease Distribution.*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Frontal	56	38.9	38.9	38.9
	Parietal	20	13.9	13.9	52.8
	Temporal	10	6.9	6.9	59.7
	Occipital	13	9.0	9.0	68.8
	Fronto-parietal	5	3.5	3.5	72.2
	Temporo-parietal	25	17.4	17.4	89.6
	Parieto-occipital	15	10.4	10.4	100.0
	Total	144	100.0	100.0	

All the patients were followed up to 2 weeks post operatively for the determination of effectiveness in terms of improvement in Karnofsky performance score of at least 20. All the above mentioned information including name, age, gender and address were recorded in a predesigned proforma. The data was entered,

stored and analyzed in SPSS version 10. Mean ± SD was calculated for quantitative variables like age, preoperative and postoperative Karnofsky performance score. Frequencies and percentages were calculated for categorical variables like gender and effectiveness.

RESULTS

Gender of Patients

out of 144 patients, there were 101 (70.1%) males and 43 (29.9%) female patients with male to female ratio of 2.35:1 (Table 1).

Age of patients

The age of patients ranged from 19 to 65 years. The mean age was 39.47 years ± 14.509 SD as given in table 2.

Karnofsky Performance Score (KFS)

Regarding preoperative karnofsky performance status, 101 (70.1%) patients were having score of less than 70 while 43 (29.9%) patients had KF score of 70 and above.

Disease Distribution

In majority of the patients, the space occupying lesion was in the frontal lobe i.e. in 56 (38.9%) followed by patients with temporoparietal gliomas 25 (17.4%). The rest of disease distribution is given in Table 3.

Table 4: *Age Relationship with Outcome.*

		Improved		Not Improved	
Age Groups	**Frequencies**	**Number**	**Percentage**	**Number**	**Percentage**
19 – 20	9	0	0	9	100
21 – 30	53	39	73.6	14	26.4
31 – 40	19	9	47.4	10	52.6
41 – 50	24	19	73.6	5	26.4
51 – 60	34	25	73.5	9	26.5
> than 60	5	0	0	5	100
Total	144	72	63.9	52	44.1

Table 5: *Relationship of Location and Outcome.*

		Improved		Not Improved	
Location	**Frequencies**	**Number**	**Percentage**	**Number**	**Percentage**
Frontal	56	48	85.7	7	133
Parietal	20	15	75	5	25
Occipital	13	9	69.2	4	30.8
Temporoparietal	25	15	60	10	40
Retro-occipital	15	5	33.3	10	66.7
Temporal	10	0	0	10	100
Total	139*			46	

*Few cases involving multiple areas

Table 6: *Karnofsky by Score and Outcome.*

		Improved		Not Improved	
KF Score	**Frequency**	**Number**	**Percentage**	**Number**	**Percentage**
More than 70	101	73	72.3	28	21.7
Less than 70	43	19	44.2	24	45.8
Total	144	92		52	

Effectiveness of the Procedure

Out of 144 patients included in the study the overall effectiveness of the procedure was observed in 63.9% (92/144) patients as shown in Table 4.

The procedure was most effective in patients with age range of 41 – 50 years 79.2% (19/24), followed by 21 – 30 years 73.6% (39/53), 51 – 60 years 73.5% (25/34) and 31 – 40 years 47.4% (9/19). The procedure was not effective in patients with age 19 – 20 years (0/9) and those above 60 years (0/5).

In total 101 male patients, the procedure was effective in 58 (57.4%) patients while in female the effectiveness was 79.07% (34/43).

Frontal lobe gliomas gave the best result 85.7% (48/56) followed by parietal lobe tumors 75.0% (15/20), occipital lesions 69.2% (9/13) temporoparietal gliomas 60.0% (15/25) and parietooccipital tumors 33.3% (5/15). The procedure was not effective in patients having temporal gliomas (0/10) (Table 5).

Surgery was effective in 72. 3 % (73/101) patients with KF score more than 70 and 44.2% (19/43) having KF score 70 or less (Table 6).

DISCUSSION

Complete cure of glioma has always been a dilemma and is considered to be a death sentence in neurosurgery. Open surgery with partial or total resection of the tumor prolongs life expectancy and improves the quality of life.

In our study, most of the patients were young or of middle age that is below the age of 61 years making 96.5% of the whole and male to female ratio was 2.35:1 which is in accordance with published literature.[2]

Different opinions exist about the effectiveness of open surgery. Some authors consider improvement in survival rate as criteria for effectiveness while others consider increase in progression free survival as criteria for success. In our study, improvement in Karnofsky performance score has been taken as scale for effectiveness of craniotomy with tumor resection.

A range of studies has demonstrated variable success rates of 24.1%[6] to 73.07%[7] for glioma surgery in terms of improvement in Karnofsky performance score. In our study, the overall effectiveness is 63.9% which is comparable to the most international studies. Yoshikawa K[8] et al showed 38.9% and Tugcu B[9] et al gave 42% effectiveness. Their results are very close to each other and are slightly lower than our results. This is because, in study performed by Yoshikawa et al, the sample size was small (18 patients) and there was no significant difference in age of the patients, tumor location and preoperative Karnofsky performance score while in series of Tugcu B et al, again the number of patients was lesser (50) than our study and most of the patients were elderly with age more than 70 years. This was probably the reason for comparatively lower success rate in their series.

In another study, Masanori Kurimoto[5] et al gave 33.3% overall effectiveness which is much lower than our series. His study included 30 patients with the age range of 70 to 81 years (median 73.0 years) while in our study, maximum age of the patients was 65 years. Thus advanced age became the possible reason for decreased effectiveness of the procedure.

In our study, most of the patients (70%) were having poor preoperative functional status with Karnofsky performance score of less than 70 but overall effectiveness was better than those of studies performed by Masanori K and Tugcu B et al. The reason was that majority of patients in our study were young with the age of 81 (56.3%) patients below 41 years that tolerated surgery in a relatively better way with fewer per-op and post-op complications. In most of the patients, maximal cytoreduction was achieved by gross total resection which added the benefit of comparatively higher success rate.

In study performed by XIE Jian[7] and colleagues, the overall success rate was 73.07% which is slightly higher than our study. Some of the aspects of their study were similar to our series like all of the patients included in their study were young and of middle age with the age range from 22 – 56 years, majority of patients were having frontal lobe tumors followed by parietal gliomas and Karnofsky performance score was determined in all patients after 2 weeks of surgery but contrary to our study, their sample size was very small (26 patients), maximum of their patients were in good preoperative functional status with KPS of 70 or above and superimposed on this, preoperative fMRI for identification of motor cortex was used in all patients. So the minor discrepancy observed in overall effectiveness is most probably due to these positive factors in the study of XIE Jian et al.

Several studies have reported the effect of tumor location on overall effectiveness and prognosis.[1o-15] Lacroix[9,13] et al. found that patients with Glioblastoma that is located in eloquent areas had better prognosis but he could not define it as an independent factor. In our study, overall success rate was also clearly influenced by tumor location. In case of frontal lobe gliomas, the procedure was most effective in improving Karnofsky performance score of 85.7% patients with these tumors, followed by parietal gliomas where it was successful in 75% of patients. The possible explanation for this improvement may be because the mass effect near the motor strip area which is responsible for hemiparesis and low Karnofsky performance score is alleviated and functional status is improved.

CONCLUSION

Open surgery with tumor resection is a very effective procedure for the treatment of supra tentorial gliomas.

Effectiveness varies with age of the patient, location of the tumor and preoperative functional status of the patient. The procedure can be used safely.

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REFERENCES

1. Chandana SR, Movva S, Arora M, Singh T. Primary Brain Tumors in Adults. Am Fam Physician, 2008; 77 (10): 1423-30.
2. Pouratian N, Schiff D. Management of Low – Grade Glioma. Curr Neurol Neurosci., 2010; 10: 224–31.
3. Oermann E, Collins BT, Erickson KT, Yu X, Lei S, Suy S et al. Cyber Knife® enhanced conventionally fractionated chemo-radiation for high grade glioma in close proximity to critical structures. Journal of Hematology and Oncology, 2010; 3: 22.
4. Stupp R, Hegi ME, Bent MJV, Mason WP, Weller M, Mirimanoff RO et al. Changing Paradigms—An Update on the Multidisciplinary Management of Malignant Glioma. The Oncologist. 2006; 11: 165–80.
5. Kurimoto M, Nagai S, Kamiyama H, Tsuboi Y, Kurosaki K, Hayashi N et al. Prognostic Factors In Elderly Patients with Supratentorial Malignant Glioma. Neurol Med Chir (Tokyo), 2007; 47: 543-49.
6. Jakola AS, Unsgard G, Solheim OJ. Quality of life in patients with intracranial gliomas: the impact of modern image – guided surgery. Neurosurg., 2011; 114 (6): 1622-30.
7. Jian X, Xu-zhu C, Tao J, Shou – wei L, Zi – xiao L, Zhong Z et al. Preoperative blood oxygen level – dependent functional magnetic resonance imaging in patients with gliomas involving the motor cortical areas. Chin Med J 2008; 121 (7): 631-35.
8. Yoshikawa K, Kajiwara K, Morioka J, Fujii M, Tanaka N, et al: Improvement of functional outcome after radical surgery in glioblastoma patients: the efficacy of a navigation – guided fence – post procedure and neurophysiological monitoring. J Neuro-oncol., 2006; 78 (1): 91-7.
9. Tugcu B, Postalci LS, Gunaldi O, Tanriverdi O, Akdemir H. Efficacy of Clinical Prognostic Factors on Survival in Patients with Glioblastoma. Turkish Neurosurgery, 2010; 20 (2): 117-25.
10. Scott JN, Rewcastle NB, Brasher PM, Fulton D, Hagen NA, MacKinnon JA, et al. Longterm glioblastoma multiforme survivors: a population – based study. Can J Neurol Sci., 1998; 25 (3): 197-201.
11. Sawaya R, Hammoud M, Schoppa D, Hess KR, Wu SZ, Shi WM, et al. Neurosurgical outcomes in a modern series of 400 craniotomies for treatment of parenchymal tumors. Neurosurgery, 1998; 42 (5): 1044-55; Discussion, 1055-6.
12. Kathleen R. Lamborn, Susan M. Chang, Michael D. Prados. Prognostic factors for survival of patients with glioblastoma: Recursive partitioning analysis. Neuro-Oncology, 2004; 6 (3): 227-35.
13. Lacroix M, Abi – Said D, Fourney DR, et al. A multivariate analysis of 416 patients with glioblastoma multiforme: prognosis, extent of resection, and survival. J Neurosurg., 2001; 95 (2): 190-8.
14. Gehan EA, Walker MD. Prognostic factors for patients with brain tumors. Natl Cancer Inst Monogr 1977; 46: 189-95.
15. Gorlia T, van den Bent MJ, Hegi ME, Mirimanoff RO, Weller M, Cairncross JG, et al. Nomograms for predicting survival of patients with newly diagnosed glioblastoma: Prognostic factor analysis of EORTC and NCIC trial 26981 – 22981 / CE.3. Lancet Oncol., 2008 9 (1): 29-38.