European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 9, Issue 6, 2022

ORIGINAL RESEARCH

Evaluation Of Functional Recovery After Surgical Resection Of Low-Grade Gliomas In Eloquent Brain At A Tertiary Care Hospital

[1]Kumar Abhinav, [2]Ankita Agrawal, [3]Rohit Kumar, [4]Arun Kumar Agrawal

[1]Senior Resident, Department of Neurosurgery, Lilavati Hospital & Research Centre, Mumbai, Maharashtra, India
[2]Senior Lecturer, Department of Conservative and Endodontics, Buddha Institute of Dental Sciences and Hospital, Patna, Bihar, India
[3]Assitant Professor, [4]Professor & Head, Department of Neurosurgery, Patna Medical College & Hospital, Patna, Bihar, India

Corresponding author
Dr. Kumar Abhinav
Senior Resident, Department of Neurosurgery, Lilavati Hospital & Research Centre, Mumbai, Maharashtra, India
Email: drabhinav11789@gmail.com

Received: 17 August, 2022 Accepted: 23 September, 2022

ABSTRACT

Aim: To assess the functional recovery after surgical resection of low-grade gliomas in eloquent brain.

Materials & methods: 30 patients with diagnosis of low-grade gliomas and undergoing resection with intra-operative electrical stimulations (IES) for the same were enrolled. The patients in which tumour involved right supplementary and primary motor areas, and the right insular lobe underwent surgery under general anaesthesia, with cortical and sub-cortical IES allowing the detection of the whole cortico-spinal pathways and vice-versa. Examination of all the patients was done immediately after surgery and after four months of surgery.

Results: Glioma was located in the supplementary motor area in 46.67 percent of the patients. Location was insular lobe in 40 percent of the patients while facial primary motor area was location the 10 percent of the patients. Glioma was located in Broca's area in 1 patient. Presenting symptoms in all the patients was seizures. While evaluating the clinical outcome, it was seen that among 14 patients with supplementary motor area involvement, Recovery within 3 months; one patient with residual right lower limb monoparesia. Among 12 patients with insular lobe involvement, Recovery within 4 months; 2 patients with mild speech deficit, 2 patients with immediate motor deficits. Among 3 patients with facial primary motor area involvement; Recovery within 3 months; 1 patient with immediate facia palsy. The patient with Broca's area involvement, recovery occurred within 1 week.

Conclusion: It is possible to carry out spatio-temporal functional re-organisation in peritumoural brain. This brain plasticity might be used to extend the limits of surgery in eloquent area.

Key words: Gliomas, Eloquent Brain, Functional Recovery.

INTRODUCTION

Low-grade gliomas are benign tumors and are grade 1 and grade 2 tumors according to WHO classification. They can be due to some genetic mutations or environmental factors that are responsible for the growth of these tumors. The presentation varies according to the location and size of the tumor. These are common in children at a young age and need early diagnosis and prompt treatment for a better prognosis.[1-3] The goal of treatment is to prolong overall survival while maintaining good quality of life (QOL). Recent data favours early surgical resection.[4] Most patients initially receive surgical resection/biopsy at time of diagnosis and then radiation therapy (XRT) and/or the single chemotherapeutic agent temozolamide (TMZ) at some point. However, many of these relatively uniformly treated patients advance more quickly than others to recurrence and death. Variation in the few known prognostic factors (most of which are themselves highly correlated), e.g. age, performance status, tumor size/location, extent of surgical resection, and histological subtype does not adequately explain the progression and survival differences in these patients. To date, the detection of treatment effect is limited.[4- 6]Hence; the present study was conducted for evaluating the Functional recovery after surgical resection of low-grade gliomas in eloquent brain.

MATERIALS & METHODS

The present study was conducted for evaluating the functional recovery after surgical resection of low-grade gliomas in eloquent brain. A total of 30 patients with diagnosis of low-grade gliomas and undergoing resection with intra-operative electrical stimulations (IES) for the same were enrolled. Complete demographic and clinical details of all the patients was obtained. Neuropsychological evaluation of all the patients was done. Pre-operative MRI was done. The patients in which tumour involved right supplementary and primary motor areas, and the right insular lobe underwent surgery under general anaesthesia, with cortical and sub-cortical IES allowing the detection of the whole cortico-spinal pathways. The patients with left and somatosensory tumours were operated under local anaesthesia with performance of intra-operative sensori-motor and language mappings. Examination of all the patients was done immediately after surgery and after four months of surgery. Quality of resection was assessed using MRI. All the results were recorded and analysed.

RESULTS

Out of 30 patients, 18 were males and 12 were females. Mean age of the patients was 45.8 years. Out of 30 patients, Glioma was located in the supplementary motor area in 46.67 percent of the patients. Location was insular lobe in 40 percent of the patients while facial primary motor area was location the 10 percent of the patients. Glioma was located in Broca's area in 1 patient. Presenting symptoms in all the patients was seizures. Among patients with supplementary motor area involvement; Posteriorly-it presented upto primary motor cortex and laterally, it extended upto language structures. Among patients with insular lobe involvement; it extended uptolnsular cortex and deeply into internal capsule along with language pathways. Among patients with Facial primary motor area involvement; it involved primary motor cortex along with pyramidal pathways. Among patient with Broca's area involvement; all language structures around the glioma with precentral gyrus. While evaluating the clinical outcome, it was seen that among 14 patients with supplementary motor area involvement, Recovery within 3 months; one patient with residual right lower limb monoparesia. Among 12 patients with insular lobe involvement, Recovery within 4 months; 2 patients with mild speech deficit, 2 patients with immediate motor deficits. Among 3 patients with facial primary motor area involvement; Recovery within 3 months; 1 patient with immediate facia palsy. The patient with Broca's area involvement, recovery occurred within 1 week.

Table 1: Demographic data

Variable	Number	Percentage
Males	18	60
Females	12	40
Mean age (years)	45.8	

Table 2: Distribution of patients according to Glioma location

Glioma location		Number	Percentage
Supplementary motor area	**Right**	10	33.33
	Left	4	13.33
Insular lobe	**Right**	9	30
	Left	3	10
Facial primary motor area		3	10
Broca's area		1	3.33

Table 3: Cortico-subcortical functional boundaries identified by intraoperative stimulation

Location	Description
Supplementary motor area	Posteriorly-it presented upto primary motor cortex and laterally, it extended upto language structures
Insular lobe	It extended upto lnsular cortex and deeply into internal capsule along with language pathways
Facial primary motor area	It involved primary motor cortex along with pyramidal pathways
Broca's area	All language structures around the glioma with precentral gyrus

Table 4: Distribution of patients according to quality of resection

Location	Number	Quality of resection
Supplementary motor area	14	Total resection in all the 14 patients
Insular lobe	12	Total resection in 8 patients and partial in 4 patients
Facial primary motor area	3	Total resection in all the 3 patients
Broca's area	1	Total resection

Table 5: Clinical outcome

Location	Number	Clinical outcome
Supplementary motor area	14	Recovery within 3 months; one patient with residual right lower limb monoparesia
Insular lobe	12	Recovery within 4 months; 2 patients with mild speech deficit, 2 patients with immediate motor deficits
Facial primary motor area	3	Recovery within 3 months; 1 patient with immediate facia palsy
Broca's area	1	Recovery within 1 week

DISCUSSION

Low-grade gliomas (LGGs) are a diverse group of primary brain tumors that often arise in young, otherwise healthy patients and generally have an indolent course with longer-term survival in comparison with high-grade gliomas. Treatment options include observation, surgery, radiation, chemotherapy, or a combined approach, and management is individualized based on tumor location, histology, molecular profile, and patient characteristics. Moreover, in this type of brain tumor with a relatively good prognosis and prolonged survival, the potential benefits of treatment must be carefully weighed against potential treatment-related risks.[7-9] Surgical intervention is performed with the goal of maximum safe resection; postoperative chemoradiotherapy showed benefits in selected patients. New treatments based on molecular profiling, new small molecule and immunotherapy approaches could improve survival and quality of life.[8, 9] Hence; the present study was conducted for evaluating the Functional recovery after surgical resection of low-grade gliomas in eloquent brain.

Out of 30 patients, 18 were males and 12 were females. Mean age of the patients was 45.8 years. Out of 30 patients, Glioma was located in the supplementary motor area in 46.67 percent of the patients. Location was insular lobe in 40 percent of the patients while facial primary motor area was location the 10 percent of the patients. Glioma was located in Broca's area in 1 patient. Presenting symptoms in all the patients was seizures. Among patients with supplementary motor area involvement; Posteriorly-it presented upto primary motor cortex and laterally, it extended upto language structures. Among patients with insular lobe involvement; it extended upto lnsular cortex and deeply into internal capsule along with language pathways. Our results were in concordance with the results obtained by previous authors who also reported similar findings. In a study conducted by Tanriverdi T et al, authors presented surgical series of frontal low-grade gliomas that were operated surgically. Tumour was localized to primary motor area in most of the cases (35%, n = 14), 25 patients were operated under general anaesthesia and 15 with awake craniotomy. New deficit rate in the early postoperative period was 32.5% (dysarthria in one patient and motor deficits in 12). Karnofsky scores were ≥90 in 92.5% of the patients at the late follow-up. 31 patients were Engel I (77.5%), 5 were Engel II (12.5%) and 4 were Engel IV (10%) postoperatively. Frontal LGGs are eligible to resect vigorously without persistent functional deficits.[10]In a similar study conducted by Abdullah A et al, authors conducted a retrospective analysis of 76 consecutive surgical cases of LGGs situated in eloquent areas. Total-near total excision in 14 (66.67%) subtotal in 6 (28.57%), and biopsy in 1 case (4.57%). In long-term follow–up, only one case experienced persistent dysphasia. In spite of its simplicity, the identification of the safe anatomical landmarks guided by the preoperative.[11]

In the present study, while evaluating the clinical outcome, it was seen that among 14 patients with supplementary motor area involvement, Recovery within 3 months; one patient with residual right lower limb monoparesia. Among 12 patients with insular lobe involvement, Recovery within 4 months; 2 patients with mild speech deficit, 2 patients with immediate motor deficits. Among 3 patients with facial primary motor area involvement; Recovery within 3 months; 1 patient with immediate facia palsy. The patient with Broca's area involvement, recovery occurred within 1 week. Similar findings were observed in past literature. In a previous study conducted by Chand EF et al, authors assessed one hundred and seventy-four patients who had high-risk LGGs that were located in presumed eloquent areas. Confirmation of tumor overlapping functional areas during intraoperative mapping was strongly associated with shorter survival. In contrast, when mapping revealed that tumor spared true eloquent areas, patients had significantly longer survival, nearly comparable to patients with tumors that clearly involved only none loquent areas, as demonstrated by preoperative imaging. Presumed eloquent location of LGGs is an important but modifiable risk factor predicting disease progression and death.[12] Intraoperative functional mapping can

improve long-term survival associated with LGGs located in eloquent brain regions. Magnetic resonance imaging can usually clearly demonstrate the location of the pre- and postcentral gyrus in the normal setting, but tumors can distort the normal anatomy of this area, necessitating intraoperative localization of these eloquent areas.[10- 12] In another similar study conducted by Duffau et al, authors described functional recovery after surgical resection of low-grade gliomas (LGG) in eloquent brain areas. Seventy-seven right-handed patients without deficit were operated on for a LGG invading primary and/or secondary sensorimotor and/or language areas. Tumours involved 31 supplementary motor areas, 28 insulas, 8 primary somatosensory areas, 4 primary motor areas, 4 Broca's areas, and 2 left temporal language areas. All patients had immediate post-operative deficits. Recovery occurred within 3 months in all except four cases. Ninety-two percent of the lesions were either totally or extensively resected on post-operative MRI. These findings suggested that spatio-temporal functional re-organisation is possible in peritumoural brain, and that the process is dynamic.[13]

CONCLUSION

It is possible to carry out spatio-temporal functional re-organisation in peritumoural brain. This brain plasticity might be used to extend the limits of surgery in eloquent area.

REFERENCES

1. Forst DA, Nahed BV, Loeffler JS, Batchelor TT. Low-grade gliomas. Oncologist. 2014 Apr;19(4):403-13.
2. Louis DN, Perry A, Reifenberger G, von Deimling A, Figarella-Branger D, Cavenee WK, Ohgaki H, Wiestler OD, Kleihues P, Ellison DW. The 2016 World Health Organization Classification of Tumors of the Central Nervous System: a summary. Acta Neuropathol. 2016 Jun;131(6):803-20.
3. Jooma R, Waqas M, Khan I. Diffuse Low-Grade Glioma - Changing Concepts in Diagnosis and Management: A Review. Asian J Neurosurg. 2019 Apr-Jun;14(2):356-363.
4. Claus EB, Horlacher A, Hsu L, Schwartz RB, Dello-Iacono D, Talos F, et al. Survival rates in patients with low-grade glioma after intraoperative magnetic resonance image guidance. Cancer. 2005;103:1227–1233.
5. Jaloka AS, Myrmel KS, Kloster R, Torp SH, Lindal S, Unsgard G, et al. Comparison of a strategy favoring early surgical resection vs a strategy favoring watchful waiting in low-grade gliomas. J Amer Med Assoc. 2012;308:1881–1888.
6. Claus EB, Walsh KM, Wiencke JK, Molinaro AM, Wiemels JL, Schildkraut JM, Bondy ML, Berger M, Jenkins R, Wrensch M. Survival and low-grade glioma: the emergence of genetic information. Neurosurg Focus. 2015 Jan;38(1):E6.
7. Central Brain Tumor Registry of the United States. Statistical Report: Primary Brain and Central Nervous System Tumors Diagnosed in the United States in 2004-2008 (March 23, 2012 Revision) Hinsdale, IL: CBTRUS; 2012.
8. Schwartzbaum JA, Fisher JL, Aldape KD, et al. Epidemiology and molecular pathology of glioma. Nat Clin Pract Neurol. 2006;2:494–503; quiz 1, 516.
9. Pouratian N, Asthagiri A, Jagannathan J, et al. Surgery insight: The role of surgery in the management of low-grade gliomas. Nat Clin Pract Neurol. 2007;3:628–639.
10. Tanriverdi T, Kemerdere R. Long-term surgical and seizure outcomes of frontal low-grade gliomas. International Journal of Surgery. 2016; 33: 60- 64.
11. Abdullah A, El Shitany H, Abbass W, Safwat A, Elsamman AK, El Refaee E. Surgical resection of low-grade gliomas in eloquent areas with the guidance of the preoperative functional magnetic resonance imaging and craniometric points. J Neurosci Rural Pract2016;7:571-6.

12. Chang EF, Clark A, Smith JS, Polley MY, Chang SM, Barbaro NM, Parsa AT, McDermott MW, Berger MS. Functional mapping-guided resection of low-grade gliomas in eloquent areas of the brain: improvement of long-term survival. Clinical article. J Neurosurg. 2011 Mar;114(3):566-73
13. Duffau H, Capelle L, Denvil D, Sichez N, Gatignol P, Lopes M, Mitchell MC, Sichez JP, Van Effenterre R. Functional recovery after surgical resection of low-grade gliomas in eloquent brain: hypothesis of brain compensation. J Neurol Neurosurg Psychiatry. 2003 Jul;74(7):901-7.