ISSN 1220-8841 (Print)
ISSN 2344-4959 (Online)

ROMANIAN
NEUROSURGERY

Vol. XXXIX | No. 4 December 2025

Surgical strategy and predicator of insular glioma in a tertiary centre

Rajendra Shrestha

DOI: 10.33962/roneuro-2025-068

Romanian Neurosurgery (2025) XXXIX (4): pp. 370-374
DOI: 10.33962/roneuro-2025-068
www.journals.lapub.co.uk/index.php/roneurosurgery

Surgical strategy and predicator of insular glioma in a tertiary centre

Rajendra Shrestha

Department of Neurosurgery, National Academy of Medical Sciences, Bir Hospital, Kathmandu, NEPAL

ABSTRACT

Introduction: The insular glioma is a rare condition in neurosurgical practice. The treatment of insular glioma lacks a distinct approach. This study aims to review the outcomes of insular glioma surgery and discuss strategies to minimise the risk in adults who have undergone initial or repeat resection of insular gliomas of all grades.
Methods: An observational study was done among 50 patients with insular gliomas who were admitted to the Department of Neurosurgery of a tertiary care centre during January 2015-August 2025. The treatment decisions and neurosurgical outcomes of the patients with insular glioma were analysed. All patients were assessed with either computed tomography, magnetic resonance imaging, or both.
Results: Among the admitted patients, the youngest patient was 25 years, and the oldest was 76 years, while there were 30 males and 20 females. Most of the patients, 42 (84%), presented with headache and 32 (64%) presented with seizures of sudden onset. Right-sided insular gliomas were observed in 27 (54%) patients, but 23 (46%) patients had left-sided tumours, and 27 (57%) patients were operated on with the Transylvanian approach and 20 (42%) patients with the transcortical approach. Extent of resection above 90% or above was achieved in 52% of cases, and EOR of 70-90% in 48% of cases.
Conclusion: The surgical approach for insular gliomas requires technical mastery of intraoperative technologies to minimise postoperative morbidity.

Keywords
craniotomy,
extent of resection,
glioma,
insular,
Transylvanian,
transcortical

Corresponding author:
Rajendra Shrestha

Department of Neurosurgery, National Academy of Medical Sciences, Bir Hospital, Kathmandu, Nepal

rajendra39@yahoo.com

INTRODUCTION

Insula is a deep and complex anatomical structure (1). The term insular cortex was first labelled by German neurologist, J. C. Reil in 1809.Insular gliomas are not uncommon, accounting for over 25% of all low-grade gliomas (LGGs) and 10% of all high-grade gliomas (HGGs) (4,13). Gliomas within the insular region have historically been difficult locations for the aggressive resection of LGGs or HGGs due to the complicated shape, organization of the insular cortex, its functional significance and its close relationship with the internal cerebral artery, the middle cerebral artery, and lenticulostriate vessels (1).Due to the significant surgical risks, some researchers have indicated that insular tumors are inoperable, opting instead for stereotactic biopsies for diagnosis, followed by chemotherapy and/or radiotherapy as alternative treatments. In contrast, other researchers have reported positive outcomes with insular tumors resections by utilizing specialized

ISSN 2344-4959 (online)
ISSN 1220-8841 (print)

First published
December 2025 by
London Academic Publishing
www.london-ap.uk

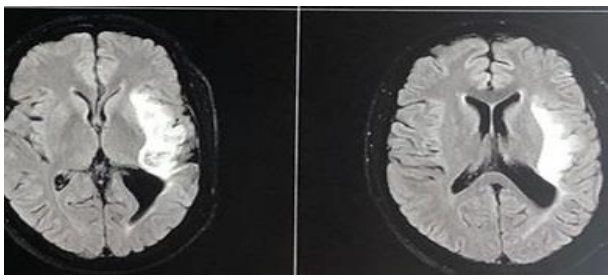
microsurgical techniques and a thorough understanding of insular anatomy. To maximize resection and reduce morbidities, the surgical strategy for insular glioma excision has necessitated a thorough grasp of surgical anatomy, glioma biology, subcortical white matter neuroanatomy, precise microsurgical technique, and intraoperative mapping (10,12,17). The aim of this study was to review the outcomes of insular glioma surgery.

Materials And Methods

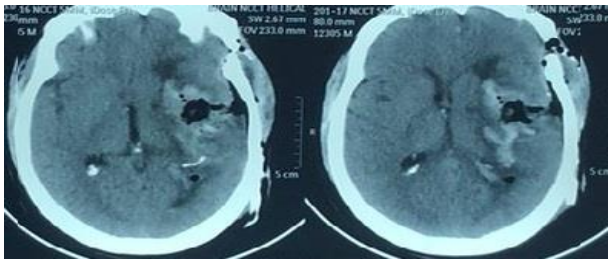
An observational study was done among 50 patients with insular gliomas who were admitted to the Department of Neurosurgery, National Academy of Medical Sciences, Bir Hospital from during January 2015-August 2025. All the insular gliomas were admitted to the neurosurgical intensive care during the study period and were included in the study. Those who received special preoperative treatment, such as radiotherapy and chemotherapy were excluded. All patients were evaluated with either a computed tomography (CT) scan, magnetic resonance imaging (MRI), or both. MRI brain is the ideal diagnosis tool for insular gliomas. Patient characteristics like age, history of hypertension/ Diabetes, Glasgow Coma Scale (GCS) on admission, routine laboratory tests, CT scan and MRI results were evaluated. We reviewed insular glioma presentation, radiological findings, and biological, anatomical, and clinical factors associated with outcomes after resecting tumors in this region. Outcome assessment was based on the data from the medical records of patients during their hospitalization, Glasgow Outcome Score (GOS) and 6-month period after discharge. Data were entered and statistically analyzed using SPSS Software.

Results

There were 30 males and 20 females with ages ranging from 25 to 76 years. Right-sided insular gliomas were observed in 27 (54%) patients but 23 (46%) patients had left-sided tumors. Most of the patients, 42 (84%) presented with headache and 32 (64%) presented with seizures of sudden onset. All patients underwent craniotomy with excision tumors except 3 (%) had undergone biopsy procedure after burr hole. Biopsy cases were old with radiologically high-grade tumors, and 27 (57%) patients were operated on with a Transylvanian approach and 20 (42%) patients with a transcortical approach. Among 6 (12%) patients who had undergone a previous resection, 4 (8%) presented with tumors recurrence and 2 (4%) had a residual tumor.

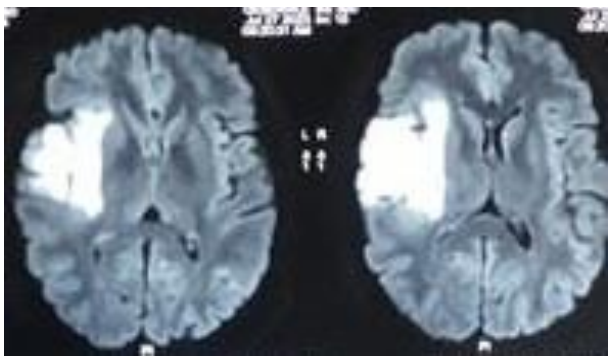


A.

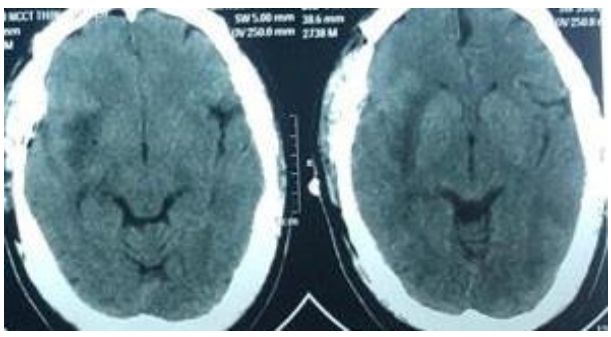


B.

Figure 1. Preoperative axial T1-weighted, magnetic resonance imaging MRI, (A) revealed expansible left insular mass lesion and immediate post-operative computed tomography (CT) scans (B) showing excision of lesion.



C.



D.

Figure 2. Preoperative axial flare MRI (C) indicated right insular mass lesion and CT scans (D) showing post-operative excision of lesion.

Among them, 5 (9%) patients had severe brain swelling post operatively who had undergone transylvian approach. All of them went to an emergency craniotomy but they developed hemiparesis and expressive aphasia. Among them, there was one mortality, even a decompressive craniectomy. Radiologically, contrast enhancement on T1 imaging and cystic insular glioma had good prognostic factors post operatively, no matter either transylvian or transcortical approach. Extent of resection 90% or above was achieved in 52% of cases, and extent of resection of 70-90% in 48% of cases. According to histological grade, there were WHO Grade II (n=33, 66%), WHO Grade III (n=14, 28%) and WHO Grade IV(n=3,6%). All patients had postoperative chemotherapy and radiotherapy as oncological protocol. All of these cases were kept in regular follow up in the outpatient department.

Discussion

Surgical resection of insular tumors was established in the 1990s by Yaşargil and Reeves (21). The insula has a pyramidal shape with an apex that was found and protected within the folds of the sylvian fissure, under the triangularis of inferior frontal gyrus and is a hidden lobe situated in the depth of sylvian fissure(16,17,18,19). A huge network of afferent connections has allowed the insula to be dedicated to a wide range of motor, sensory, affective, and cognitive tasks (9,11). The main objective of surgery is to remove as many insular gliomas as possible while preserving the patient's speech and motor function and increasing their chances of survival. Combination of microsurgical technique, cortical mapping, and insular anatomy are needed for the resection of insular glioma. Both the transylvian and transcortical corridors to the insula are associated with low morbidity profiles (1, 6,8,12,15, 16)

MRI plays a significant part in the diagnosis and further characterization of insular glioma. In order to reach a maximal safe resection of these invasive tumors, advanced imaging systems, such as perfusion imaging, diffusion imaging, spectroscopy, and positron emission tomography (PET) imaging, have become progressively valuable surgical tools, particularly, when used in combination with intraoperative brain mapping (3,8,9,11, 16). In our series, contrast enhancement on T1 imaging and cystic lesions had good prognostic factors in insular glioma.

The insular cortex receives a rich blood supply from the internal cerebral and middle cerebral arteries. The middle cerebral artery bifurcates at the limen insula, giving rise to between 1 and 6 insular M2 branches that cover the surface of the insula. The M2 branch located over the central insular sulcus terminates as the rolandic artery, and understanding this can help prevent damage to the vessel. The lenticulostriate arteries traverse the anterior perforated substance and can be challenging to identify and preserve during surgery for insular gliomas (1,9,21). Surgical intervention of glial tumors located in the insula is particularly difficult because of the close proximity to the internal capsule. Around 95% of patients had fewer neurological deficits, allowing them to function independently and eventually return to work overtime (2 ,4,5,7,8). These results demonstrated that a pterional craniotomy with microsurgical approach to insular tumors could be considered. In the English literature, surgeons meticulously dissected anatomical structures and described surgical techniques to maximize safety (2,6). There are some recommendations: 1) Broad splitting of the sylvian fissure, 2) awake craniotomy with cortical and subcortical mapping to identify the overlying motor cortex tract and the internal capsule subcortically, and 3) meticulous suprasylvian dissection to avoid coagulation of the long perforating M2 segment and lateral lenticulostriate arteries during insular tumor resection. and 4) tumor removal piecemeal manner through windows created between vascular structures (3,6,9,10). The transcortical approach emphasizes a subpial resection of the insula lesion which has expanded popularity with the evolution of intraoperative mapping techniques and awake craniotomies (1). Berger et al. reported transcortical approach to insular tumors series and divided the insula into four zones to establish surgically relevant insular function and to correlate with outcome surgical resection (1,5,6). Ultimately, the approach is a multifaceted decision and involves the knowledge of the individual surgeon as well as patient presentation, anatomy and neurological function.

In this study the incidences of insular gliomas in males were 60% and 40% in females which is in contrast to another study, where male and female

incidence was 42% and 62% respectively (17,18). In another study, seizure was found to be the most common presentation in 70.6% patients and in similar another study found in 55.1% patients 2,3 but in our study most common symptom was headache in 42 (84%) followed by seizure 16 (32%). Left side of tumor was more common (55.7%), whereas in our study right side tumors were more common 54% and left side tumors were seen in 46% patients (17,18). In our study, WHO grade 2 tumor was most common accounting to 66%, whereas in another study, WHO grade 2 tumor was most common in 65.7% patients and 34.3% patients had WHO Grade 3 tumor. In a similar study, EOR above 90% was achieved in 42% of cases, and EOR of 70-90% in 51% of cases, which was similar to our findings in which extent of resection 90% or above was achieved in 52% of cases, and extent of resection of 70-90% in 48% of cases (6,10, 14,15,18,20).

Tumor resection improves survival, but increasing extent of resection poses a risk of neurological compromise. This study is the first in the literature to analyze predictors of insular glioma. Predictors of poor outcome involved WHO grade IV glioblastomas, advanced age, diabetes and transylvian approach. Predictors of favorable outcome comprised younger age at diagnosis (< 40 years); contrast enhancement on T1 imaging and cystic insular glioma radiologically, EOR > 90%, WHO grade I, II, and III histologically; and transcortical surgical approach. This study was an observational study of a single institution and included a small sample size. So, this study cannot be generalized among the whole population of Nepal. We recommended further prospective study to know better prognostic factors of insular glioma.

Conclusion

Insular glioma surgery is challenging surgery due to its peculiar anatomical characteristics and carries substantial morbidity and complications. Younger age; radiologically contrast enhancement on T1 imaging and cystic lesion, transcortical surgical approach, EOR > 90%, and histologically WHO grade I, II, and III ad predicated as favorable outcome in insular glioma surgery.

References

1. Benet A, Hervey-Jumper SL, Sánchez JJ, Lawton MT, Berger MS: Surgical assessment of the insula. Part 1: surgical anatomy and morphometric analysis of the transsylvian and transcortical approaches to the insula. J Neurosurg . 2016; 124:469–481.
2. Duffau H: A personal consecutive series of surgically treated 51 cases of insular WHO GRADE II glioma: advances and limitations J Neurosurg. 2009; 110:696-708.
3. Duffau H, Moritz-Gasser S, Gatignol P: Functional outcome after language mapping for insular World Health Organization Grade II gliomas in the dominant hemisphere: experience with 24 patients. Neurosurg Focus. 2009;27(2): E7.
4. Hervey-Jumper SL, Berger MS. Insular glioma surgery: an evolution of thought and practice. Journal of Neurosurgery. 2019 Jan 01;130(1):9-16.
5. Hervey-Jumper SL, Li J, Osorio JA, Lau D, Molinaro AM, Benet A, et al.: Surgical assessment of the insula. Part 2: validation of the Berger-Sanai zone classification system for predicting extent of glioma resection. J Neurosurg. 2016; 124:482–488.
6. Lang FF, Olansen NE, DeMonte F, Gokaslan ZL, Holland EC, Kalhorn C, et al.: Surgical resection of intrinsic insular tumors: complication avoidance. J Neurosurg .2001;95: 638–650.
7. Ius T, Pauletto G, Isola M, Gregoraci G, Budai R, Lettieri C, et al.: Surgery for insular low-grade glioma: predictors of postoperative seizure outcome. J Neurosurg. 2014; 120:12–23.
8. Michaud K, Duffau H: Surgery of insular and paralimbic diffuse low-grade gliomas: technical considerations. J Neurooncol .2016;130(2):289–298.
9. Moshel YA, Marcus JD, Parker EC, Kelly PJ: Resection of insular gliomas: the importance of lenticulostriate artery position. J Neurosurg. 2008; 109:825–834.
10. Nader Sanai, Mei-Yin Polley, Mitchel S. Berger, Insular glioma resection: assessment of patient morbidity, survival, and tumor progression J Neurosurg .2010;112:1–9.
11. Naidich TP, Kang E, Fatterpekar GM, Delman BN, Gultekin SH, Wolfe D, Ortiz O, Yousry I, Weismann M, Yousry TA;The insula: anatomic study and MR imaging display at 1.5 T. AJNR Am J Neuroradiol. 2004;25(2):222–232.
12. Przybylowski CJ, Baranoski JF, So VM, Wilson J, Sanai N: Surgical morbidity of transsylvian versus transcortical approaches to insular gliomas. J Neurosurg. 2019;1 0.3171/2018.12. JNS183075.
13. Reil J: Die Sylvische Grube. Arch Physiol (Halle).1809;9:195–208.
14. Renfrow JJ, Julian B-Q, Brown DA, Tatter SB, Laxton AW, Lesser GJ, et al. A Review on the Surgical Management of Insular Gliomas. Canadian Journal of Neurological Sciences. 2023;50(1):1-9.
15. Roberto Rey-Dios, Cohen-Gadol AA. Technical nuances for surgery of insular gliomas: lessons learned. Neurosurg Focus. 2013 Feb;34(2): E6.

16. Safaee MM, Englot DJ, Han SJ, Lawton MT, Berger MS: The transsylvian approach for resection of insular gliomas: technical nuances of splitting the Sylvian fissure. J Neurooncol .2016;130:283–287.
17. Sanai N, Mirzadeh Z, Berger MS: Functional outcome after language mapping for glioma resection. N Engl J Med. 2008; 358:18–27.
18. Sanai N, Polley MY, Berger MS: Insular glioma resection: assessment of patient morbidity, survival, and tumor progression. J Neurosurg. 2010; 112:1–9.
19. Skrap, M, Mondani, M, Tomasino, B, et al. Surgery of insular nonenhancing gliomas: volumetric analysis of tumoral resection, clinical outcome, and survival in a consecutive series of 66 cases. Neurosurgery. 2012; 70:1081–93.
20. Vanaclocha V, Sáiz-Sapena N, García-Casasola C: Surgical treatment of insular gliomas. Acta Neurochir (Wien) .1997;139:1126–1135.
21. Yaşargil MG, von Ammon K, Cavazos E, Doczi T, Reeves JD, Roth P: Tumours of the limbic and paralimbic systems. Acta Neurochir (Wien).1992;118:40–52.