



Efficacy of Tanssylvian Transinsular Approach in Management of Lateral Thalamic and Basal Ganglia Lesions: A Series of Seven Cases and Review of Literature

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Abstract

Back Ground: Surgical management of thalamic and basal ganglion lesions is challenging and require precise preoperative planning according to site and close relationship to the surrounding structures especially internal capsule and eloquent cortex.

Transsylvian transinsular approach offers best option for lateral thalamic and basal ganglion lesions

Aim: To access efficacy and safety of transsylvian transinsular approach in management of lateral thalamic and basal ganglion lesions

Settings and Design: A retrospective case series study of 7 patients with thalamic and basal ganglia lesions operated upon by transsylvian transinsular approach in the period between January 2021 to June 2023 comparing preoperative to postoperative parameters and review of literature

Materials and Methods: 7 patients with lateral thalamic and basal ganglion lesions scheduled for surgery using transsylvian transinsular approach comparing preoperative and postoperative parameters including GCS , motor power for upper limbs and lower limbs were accessed according to The Medical Research Council (MRC) Scale for Muscle Strength , functional status according to Karnofsky score , blood loss and hospital stay.

Results: During the study period 7 patients were managed by using this approach, 6 patients showed no post operative worsening of neurological condition at the end of follow up period compared to preoperative parameters , and one case of mortality due to sepsis and ICU complications.

Conclusions: The transsylvian transinsular approach is safe effective anatomical procedure for management of lateral thalamic and basal ganglion lesions.

Keywords : Insula; Thalamus; Transsylvian Trans insular

Introduction

Because of their depth and close proximity to important structures, especially in the dominant hemisphere, lesions in the thalamus and basal ganglia might be dangerous to resect [1]. Increased intracranial pressure, hydrocephalus, focal motor and sensory findings, tremor, visual issues, cognitive symptoms, and occasionally seizures are the signs and symptoms that these lesions present with [2] When accessing deep-seated lesions in the thalamus and basal ganglia, the transsylvian-transinsular approach offers the least amount of cortical transgression and the shortest surgical distance without endangering the adjacent eloquent frontal and temporal lobes, even in the dominant hemisphere [3] Noted disadvantages of this approach are narrow operative corridor, less familiar and proximity to branches of middle cerebral artery [4] This approach has been described many years ago, but rarely published so In our study we will discuss the efficacy of transsylvian transinsular approach and describe our experience with using this approach in management of number of lateral thalamic and basal ganglion lesions.

Materials and Methods

- This is a retrospective study performed in neurosurgery department cairo university including 7 patients in the period from January 2021 to June 2023 with lateral thalamic and basal ganglia lesions scheduled for surgical intervention using transsylvian transinsular approach
- All patients included were subjected to full history, neurological examination and general examination
- All patient were assessed preoperatively for conscious level according to GCS and motor power for upper limbs and lower limbs were assessed according to The Medical Research Council (MRC) Scale for Muscle Strength and functional status according to Karnofsky score.
- Full labs and pre anesthesia investigations were performed.
- All patients had preoperative MRI brain with contrast and CT brain for assessment of hydrocephalus 24 hours postoperative conscious level and motor power were assessed also functional outcome using karnofsky performance scale was reported.
- Intraoperative blood loss and hospital stay data were analyzed as secondary outcome.
- Follow up data of the patients was reviewed 24 hours and 6 months postoperative including radiological follow up and clinical parameters used and settled preoperatively for comparison

Surgical technique

In order to make the sagittal suture almost parallel to the floor, patients were placed supine and had their heads rotated to the contralateral side. A question mark incision was made, centered at a spot along the posterior sylvian fissure's surface projection. A craniotomy was performed after the incision was deepened through the fascia and temporalis muscle. after which the dura is opened. A minor bridging vein may occasionally be scarified to increase the opening space of the sylvian fissure along its length, allowing smooth separation of the operculum. The post-sylvian fissure was identified by the superficial middle cerebral vein, and the M4 branches emerging the fissure along both opercula arachnoid were sharply opened over the veins on the frontal side [5]. The sylvian fissure needs to be opened all the way along for good visualization of the insula. Above the insular cortex is where the M2 portion of the middle cerebral artery emerges. The direction of exploration, which should follow the posterior limit of the posterior limb of the internal capsule, is indicated by the identification of the posterior portion of the insular region. The tumor can be found beneath the insular cortex following a tiny incision made in the middle of the insula's postcentral sulcus. This surgical approach is made possible by our precise understanding of the complex topographical and circulatory architecture of the insular region [6] In certain instances, gentle mechanical retraction over a cottonoid was used to enter the posterior insular cortex, where the lesion was discovered beneath a thin layer of cortical tissue. However, mechanical retraction of the operculae was minimized as initial tumor debulking made a space to work. The lesion was then excised using a standard microsurgical method, being careful to keep it inside the tumor. Hemostasis and standard closure came next.

Results

This study included 7 patients 4 males and 3 females operated up on by transsylvian transinsular approach for lateral thalamic and basal ganglia lesions including 4 left sided lesions and 3 right sided lesions in neurosurgery department cairo university in the period between January 2021 and june 2023. Age of patients ranges from 5 years to 63 years with mean 41.85 ± 20.9 years. According to preoperative assessment of the patients preoperative GCS was ranging from 7 to 15 with mean 13.28 ± 2.9 Preoperative Motor power of upper limb was rangin from 0 to 5 with mean 3 ± 2.16 and motor power of lower limb was ranging from 0 to 5 with mean 3.14 ± 2.19 Regarding preoperative assessment of functional state of patients using karnofsky outcome scale it was ranging from 10 to 80 with mean 58.57 ± 27.34 . Intraoperative bood loss was documented and was ranging from 250cc to 500cc with mean 392.85 ± 97.59 . Postoperative assessment of patients was

documented 24 hours and 6 months 24 hours postoperative conscious level was ranging from 7 to 15 with mean 12.85 ± 2.76 and by the end of 6 months follow up period 6 patients regain full consciousness 15 and a patient died postoperative due chest infection and sepsis. Regarding assessment of motor power 24 hours postoperative upper limb motor power was ranging from 0 to 4 with mean 2.42 ± 1.71 and lower limb ranging from 0 to 4 with mean 2.57 ± 1.81 but after 6 months follow up motor power of upper and lower limbs showed improvement compared to preoperative values ranging from 0 to 5 with mean 3.83 ± 0.7 For follow up of functional state 24 hours postoperative karnofsky score was ranging from 10 to 70 with mean 50 ± 22.36 with mild decrease in functional state compared to preoperative assessment but after recovery period during the 6 months follow up karnofsky scale showed improvement compared to preoperative assessment values ranging from 40 to 100 with mean 67.14 ± 35.45 after exclusion of the mortality case. Hospital stay was ranging from 3 to 10 days with mean 5.57 ± 2.37 Regarding postoperative assessment of speech in the 4 patients of the left sided lesions two patients experienced temporary dysphasia which improved till complete recovery. Pathology of the 7 operated patients included one case of pilocytic astrocytoma, one case of anaplastic astrocytoma grade 3, one case of pleomorphic xantho-astrocytoma with anaplastic features, 3 cases of GBM and one case of hypertensive hematoma which is the mortality case (Figure 1,2).

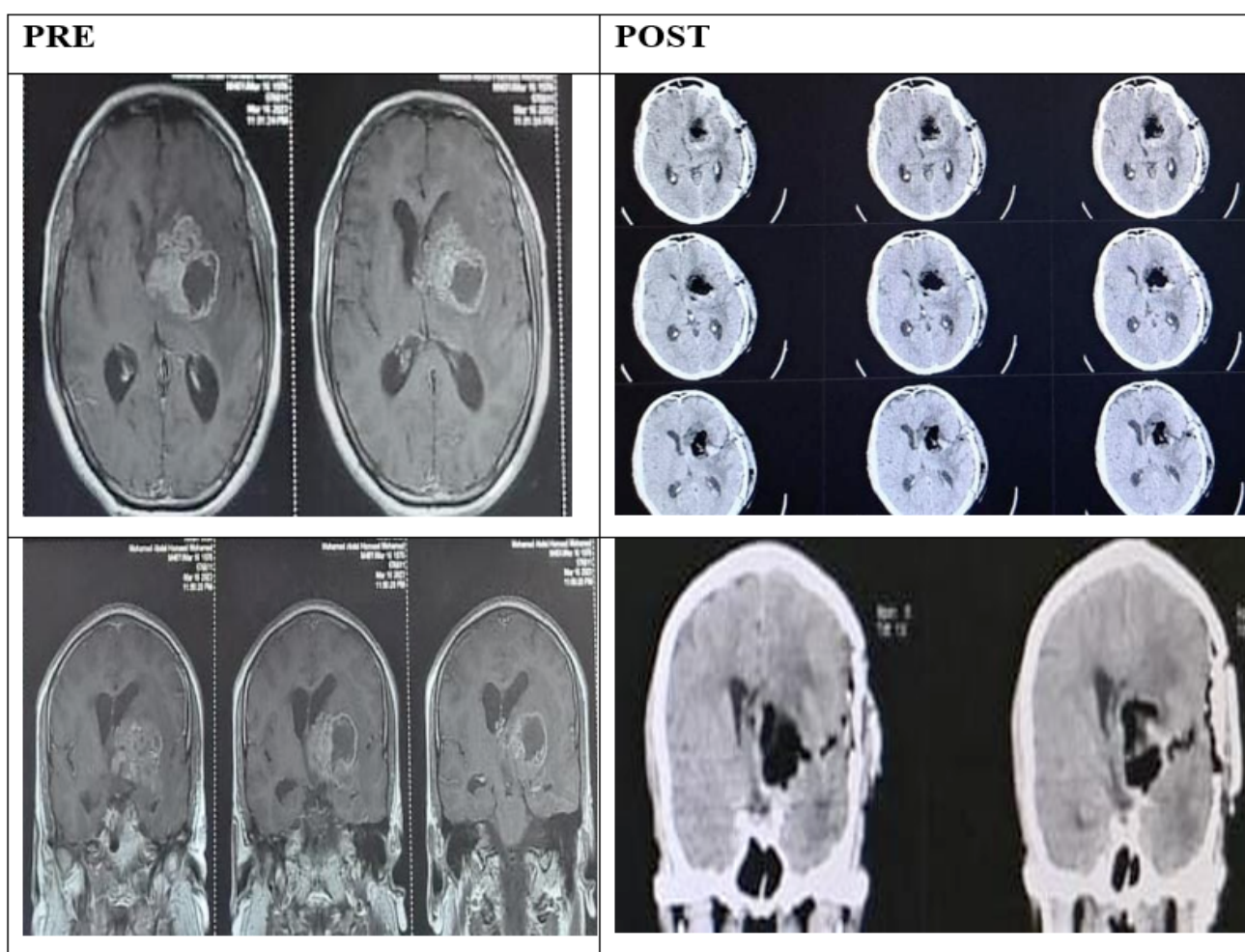


Figure 1: showing pre and post operative images of 45 y old patient with left lateral thalamic lesion operated by transsylvian transinsular approach pathology revealed pleomorphic xanthoastrocytoma with anaplastic features grade 3.

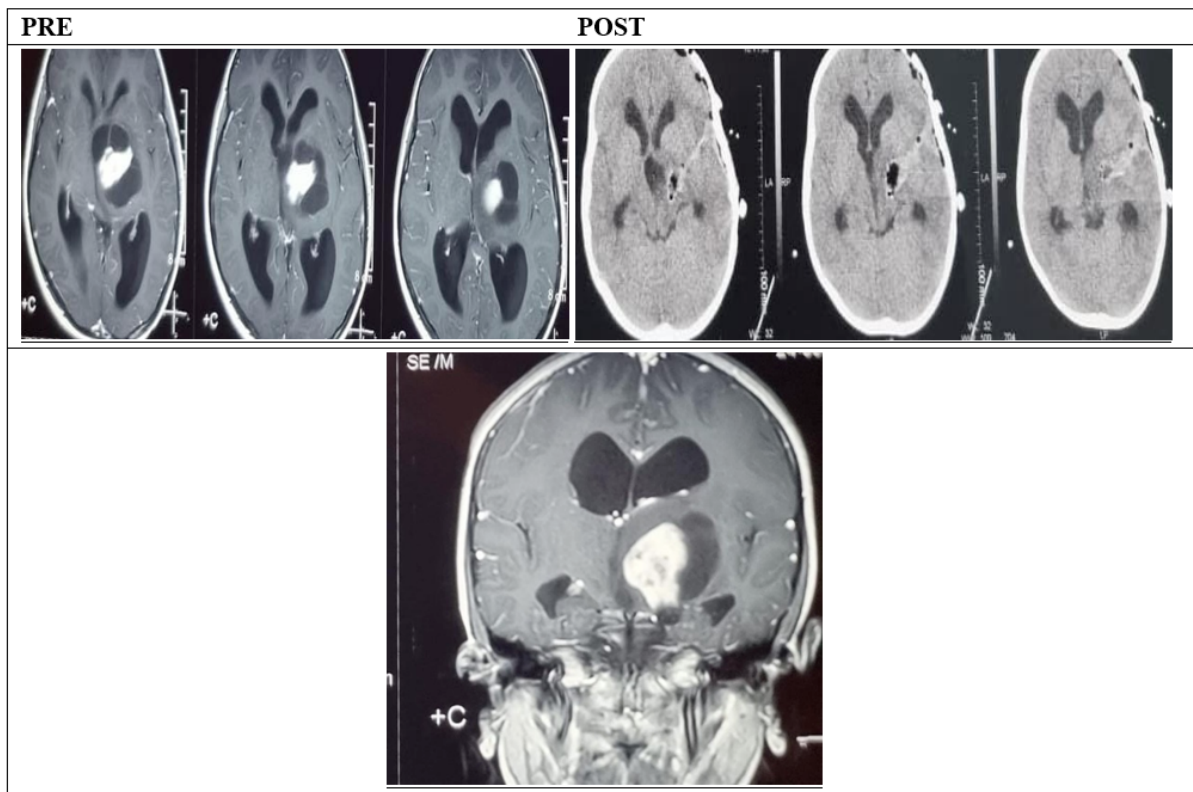


Figure 2: Showing pre and postoperative images of 5 year old male patient with left lateral thalamic lesion operated by transsylvian transinsular approach pathology revealed pleomorphic pilocytic astrocytoma grade 1.

Discussion

Historically diencephalic lesions including thalamic and basal ganglion lesions were considered irresectable and inoperable lesions due to close proximity to vital structures such as internal capsule, subthalamus and hypothalamus. These lesions are no longer incurable thanks to advancements in microsurgical techniques, neuromapping, and knowledge of microsurgical anatomy. Recent studies have shown that vigorous surgical resection can enhance outcomes. Complete removal of benign tumors from the thalamus as well as improved survival rates when high-grade tumors are removed [7,8] and Kramm et al., 2011). Three different patterns of the growth and expansion of thalamic lesions were explained by Yasargil. An exophytic tumor grows under the ventricular ependymal layer when it originates from the thalamus near the ventricular surface. Brain tumors that start in one of the thalamic nuclei stay localized and push out the surrounding structures as they grow. The third class of tumors can grow upward and laterally into the white matter of the surrounding gyrus; they expand toward the posterior insula and Sylvian fissure. Instead of infiltrating the circulatory structures and cortical bundles, tumor

expansion causes the tumor to exhibit and [9]. Depending on which area of the thalamus is the lesion or the tumor origin, several surgical techniques have been employed to remove thalamic lesions. Because of the direct relationship between the thalamus and the lateral ventricle, transventricular methods are the most commonly used method. Transcortical or interhemispheric approaches can also be used to gain access to the ventricle and subsequently the thalamus. Transcortical techniques avoid veins but require epileptogenic cortical incision; interhemispheric procedures may impact the bridge cortical veins [10,11]. Transparietal transatrial approaches require a long corridor to reach the target in the absence of ventriculomegaly, and they may have an impact on the superior loop of optic radiation [12]. Direct transcortical methods to the lesions in the ventrolateral thalamus are directed through the temporal cortex, which carries an additional risk of cortical incision. This raises the possibility of damage to the dominant hemisphere's Wernicke's area and Meyers loop. The transsylvian transinsular approach to the lateral thalamic tumors offers a surgical corridor without violation of eloquent cortex [13,5], but the main argument of this approach and less familiarity is that anatomically it appears to pass through the internal capsule especially the

retrolenticular part but as most patients do not present with profound weakness so it raise the possibility of that the lesions display the white matter tract and not infiltrating it finding its way superfascially to the insula .

In our study this approach offered effective and safe surgical approach for the management of 7 patients with lateral thalamic and basal ganglion lesions. The most common presentation was motor affection of the contralateral side. There was temporary postoperative mild affection of the motor power and karnofsky score compared to preoperative that were improved gradually within follow up period. At the end of follow up period motor power and karnofsky score were better than preoperative measurements. Immediate postoperative mild temporary worsening of motor power and karnofsky score could be explained by temporary odema at tumor bed caused by surgical manipulation that improved gradually till recovery. In 2012, Shashwat Mishra et al. carried out a retrospective analysis including 10 patients by analyzing the literature. This method was used to operate on seven tumors and three hypertensive thalamic hematomas. During the perioperative phase, they experienced one death. After the thalamic hematoma was evacuated, one patient is still in a persistent vegetative state; nevertheless, patients with thalamic lesions other than hypertensive thalamic hematoma did not experience a worsening of their preoperative deficits following surgery, which is consistent with our findings [5] M. Memet Özek et al. carried out a retrospective study over a ten-year period, involving 18 patients, two of whom underwent transinsular surgery. They concurred with our findings and reported that, provided there is a close relationship between the tumor and the insula, tumors within the ventral posterior thalamic region can be radically resected with good outcomes using this approach [6] Regarding hypertensive thalamic and basal ganglion hematoma extent of evacuation, transsylvian transinsular approach was superior to transcortical trans temporal approach that was documented by Seung Hwan Kim et al in their retrospective study in the period between 2011 and 2014 [14,15,16].

Conclusion

Surgical management of Diencephalic lesions including basal ganglion and thalamic lesions is challenging and require precise surgical planning based on the anatomical site ,size and close relations of lesion to surrounding structures especially internal capsule,MCA branches and surrounding eloquent cortex in dominant hemisphere.

In our opinion, for lateral thalamic and basal ganglion lesions with close relationship to insula transsylvian transinsular route offer the best approach with the shortest corridor and least manipulation of eloquent cortex especially in dominant hemisphere. Success of this approach depend on experience of the surgeon and precise preoperative planning but it still carry risk of internal capsule

affection that can be more minimized using neuronavigation and preoperative MRI functional tractography.

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