



EVALUATION OF SURGICAL OUTCOME USING NEURO NAVIGATION AND FLUORESCEN DYE IN GLIOMA

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ABSTRACT **AIM :** To evaluate the application of sodium fluorescein dye and Neuronavigation techniques in the resection of Brain Gliomas in patients of different ages **METHODS :** In our institution we have conducted this study from July 2022 to December 2022. We have included 26 cases of gliomas both high grade and low grade gliomas in this study. Patient who under went a neurosurgical intervention using Neuro Navigation and Fluorescein Sodium under Leica microscope, either neuro navigation alone or fluorescein sodium under leica microscope alone and in third category both were not used **CONCLUSION:** Based on the data collected in these 26 patients, the use of intravenous fluorescein during surgery for glioma and neuro navigation with a dedicated filter integrated into the surgical microscope appears safe and able to allow a high rate of complete resection and no damage to the eloquent areas, reduction in intraoperative time, less damage to neurovascular structures.

KEYWORDS : Neuronavigation, Brain gliomas, Sodium fluorescein dye

INTRODUCTION

Gliomas are most common primary malignant intracranial tumours¹. According to the current WHO grading system, survival rate for gliomas is low. Several other factors interfere with the prognosis are radiological features, location of tumor in eloquent areas, subtotal/partial resection, time duration of surgery & anesthesia duration, high grade gliomas WHO Grade iii & IV tumors and postoperative care. Recent studies have showed that survival rate depends upon radical resection². Factors helping to achieve radical resection using neuro navigation and fluorescein sodium under Leica microscope⁽³⁾ (4). Good post operative outcome following significant reduction of tumor in post operative scan.

Materials and methods

In our institution we have conducted this study from July 2022 to December 2022. We have included 26 cases of gliomas both high grade and low grade gliomas in this study. Patient who under went a neurosurgical intervention using neuro navigation and fluorescein sodium under Leica microscope, either neuro navigation alone or fluorescein sodium under leica microscope alone and in third category both were not used. Risk factors , duration of surgery, anesthesia, benefits and outcome were evaluated and closely monitored during preoperative, intra operative and post surgery.

CLINICAL AND RADIOLOGICAL ASSESSMENT

The Patients' General And Physical Status Both Pre- And Postoperatively Assessed By Karnofsky Performance Status (KPS). Data from laboratory tests were also recorded. The patients' neurological function was assessed by means of the Mini Mental State Evaluation (MMSE) and Glasgow coma scale (GCS). Clinical assessment consisted of a preoperative visit within 14 days of surgery and an immediate postoperative evaluation within the first 72 hours after surgery. All patients underwent MRI studies with a 1.5-T scan with the use of a contrast Agent and T1 contrast 1mm cuts were made and recorded in the DVD with supporting software stealth neuro navigations system. The postoperative CT brain performed for all cases within the first 72 hours after surgery. Significant volume reduction in patients using both neuro navigation and fluorescein dye compared to the patients were both not used.

INCLUSION CRITERIA

1. Age less than 50 years.
2. Normal renal parameters.
3. Eloquent areas of brain.
4. Tolerating the time duration during MRI.
5. Newly diagnosed gliomas (with the tentative diagnosis being based on brain MRI with contrast.
6. Tumor location allowing for complete resection of contrast-

enhancing area as determined by the surgeon.

EXCLUSION CRITERIA

1. Severe heart, liver or kidney disease.
2. Recent acute ischemic stroke.
3. Prior history of hypersensitivity fluorescein to or severe reactions to other contrast agents⁸.
4. Pregnancy.
5. CP Angle tumour.
6. Meningioma.
7. preoperative KPS (Karnofsky Performance Status) score of 60 or less.

PROTOCOLS

Neuronavigational data can be reconstructed in three dimensions to simulate a surgical approach prior to surgery⁵. All the patients satisfying inclusion criteria under went MRI brain plain and contrast with MRA, MRV, MRS with 1mm cuts. (conventional MRI were 5 mm cuts). Images were copied in DVD and import these Images and registered in stealth neuro navigation system is a key component.

Planning and matching of all the images in the stealth system is done prior to the induction of anesthesia to save the time. Shortest entry point and shortest route to reach the tumor is set. Mid point of the tumor is also fixed. Tumor segmentation is done by color painting.

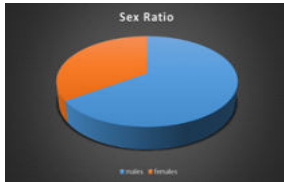
Brain mapping and an operative trajectory is set in the structural model avoiding injuries to vital structures and eloquent areas. Synchronizing the 3D structural model with the patient after the anesthesia. Conforming the bony prominence of the patient with the model. In all cases 5 mg/kg body weight of fluorescein sodium, 50% of this dilution was injected intravenously after test dose, after the induction of anesthesia. Vital were monitored for 15 min. Next 50% of this dilution is injected during dural opening. Neuro navigation was used for tumor localization. Once tumor is reached, the microscope setting is changed to YELLOW 560nm fluorescence filter (7), tumor margin and cell uptake by fluorescent dye is well demarcated. This helped to achieve complete resection of tumor as much as possible, exact localization, less operative time, less damage to vital neurovascular structure, less retraction of the brain parenchyma.

DISCUSSION

Fluorescein injection after intubation and before skin incision, patients received 5–10 mg/kg of a 20% solution of sodium fluorescein , administered intravenously. A dedicated surgical microscope BLU 400 or YELLOW 560, Leica was used during the surgical procedure. Specifically designed by the Leica Microscope Company for excitation in the wavelength range of 460–500 nm and for observation

in the wavelength range of 540–690 nm⁷. Consequently, it was possible to reduce the fluorescein dosage to 5 mg/kg³.

Neuro navigation was allowed for surgical planning, initial tumor localization, and orientation during tumor removal, and for the assessment regarding extent of resection. During resection, the microscope could be switched alternatively from fluorescent to white-light illumination, as by the surgeon's choice, by pressing the specific button on the microscope handgrip. However, with the YELLOW 560 filter⁷, as already described, it was possible to visualize the fluorescent signal and at the same time the nonfluorescent tissue in more natural color.



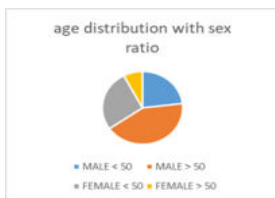
In this study total 26 cases, out of which 17 males and 9 females have included in our study. In our study we did not mean that prevalence of male is more than female. We have picked up the samples satisfying our inclusion and exclusion criteria.

Age distribution



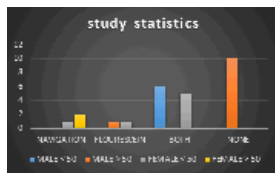
Age distribution in our random samples were 13 cases less than 50 years of age and 13 cases more than 50 years of age.

Age Distribution with Sex Ratio

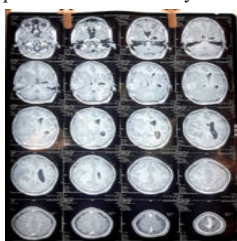


6 cases were less than 50 years and 11 cases were more than 50 years in male population and 7 cases were less than 50 years and 2 cases were more than 50 years in female population were included in our study.

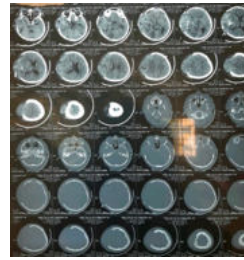
Our study statistics



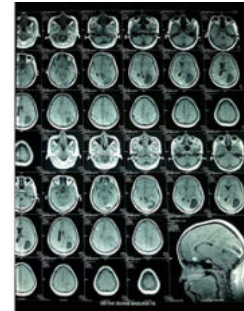
In our study both neuro navigation and fluorescein dye were used in 11 cases out of which 6 patients are male less than 50 years old and 5 patients are female less than 50 years old. In 10 patients we did not use either neuro navigation nor fluorescein dye for various risk factors and to avoid complications and all of them are male sex with age more than 50 years. Fluorescein alone used in 2 patients 1 was male more than 50 years and 1 was female patient less than 50 years. Neuro navigation alone used in 3 patients and all of them are female and 1 patient less than 50 years and 2 patients more than 50 years.



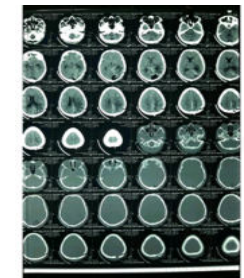
Picture A pre operative MRI showing rt Temporal lobe high grade glioma



Picture B significant tumour volume reduction in immediate post operative CT brain



Picture C MRI BRAIN showed well defined cystic mass with internal septation and peripheral enhancing irregular solid components



Picture D significant tumour volume reduction in post operative CT brain

CONCLUSIONS

Imaging follow-up included MRI with and without contrast agent. Based on the data collected in these 11 patients, the use of intravenous fluorescein during surgery for glioma and neuro navigation with a dedicated filter integrated into the surgical microscope appears safe and able to allow a high rate of complete resection and no damage to the eloquent areas, reduction in intraoperative time, less damage to neurovascular structures.

Post operative significant tumour volume reduction in CT brain⁹ 10. Patients underwent clinical and radiological follow up examinations within 4 weeks after the end of radiochemotherapy and then every 2 to 6 months. The clinical evaluation included the same tests performed at the preoperative and early postoperative periods.

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