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Original Article

Clinical outcome and safety of different approaches to surgical resection for medial temporal lobe gliomas

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Abstract: Objective: The aim of this study was to explore clinical outcome and safety of different approaches to surgical resection for gliomas of medial temporal lobes. Methods: Between January 2014 and December 2017, 92 patients with glioma of medial temporal lobes, scheduled to undergo surgical resection, were recruited into this study. They were randomly divided into the observation group (n=46) and the control group (n=46). Patients in the observation group were assigned to receive surgical resection via a lateral fissure approach, whereas those in the control group were to undergo surgical resection via a trans-temporal approach. Patients in the two groups were compared regarding clinical response to the two different approaches, improvements in clinical symptoms, surgical resection profile, quality of life (QoL), and postoperative visual impairment. Results: Preoperative clinical symptoms and QoL differed insignificantly between the two groups (both P>0.05). After surgical treatment via the alternative approach, postoperative clinical symptoms and QoL of patients improved considerably (both P<0.05); there were no substantive disparities in the clinical response to surgical resection, extent of surgical resection, postoperative clinical symptoms, and QoL of patients between the two groups (all P>0.05). However, incidence of visual impairment (6.52%) was substantially lower in the observation group than that (39.12%) in the control group (P=0.001). Conclusion: The lateral fissure approach and the trans-temporal approach to surgical resection were effective in treating gliomas of medial temporal lobes, but the lateral fissure approach was associated with remarkably lower incidence of postoperative visual impairment and higher safety than the trans-temporal approach.

Keywords: Lateral fissure approach, trans-temporal approach, glioma, surgical outcomes, postoperative visual impairment

Introduction

Brain glioma originates from the mutation of neuroglial cells. The tumor frequently compresses neurovascular tissues and affects normal functioning of the body. It is the most common primary brain tumor [1, 2]. A report from clinical epidemiological research has indicated that morbidity of cerebral glioma increases yearly and cerebral glioma has increased up to 50% of all intracranial tumors [3]. Clinically, the major manifestations of cerebral glioma are papilledema, headache, epilepsy, and endocrine disorders, resulting from compression on the function region and intracranial hypertension [4, 5].

Previous studies have shown that there are no special treatment methods for cerebral gliomas and most patients undergo surgical resection in clinical practice [6, 7]. Additionally, cerebral gliomas at different sites need different methods of surgical resection, with clinical outcomes varying greatly [8]. Glioma of medial temporal lobes, a common subtype of cerebral glioma, refers to lesions occurring within the limbic system, namely, cingulate gyrus, lower corpus callosum, hippocampus and amygdala, and other structures [9]. The medial temporal lobe structure is the most complicated intracranial structure at a deeper location adjacent to important structures including the posterior cerebral aorta, oculomotor nerve, and brainstem [10]. Accordingly, when these tumors are resected surgically, the operation is difficult and at high risk. Research has been performed regarding the anatomy and surgical approaches to medial temporal lobes, but studies are still not systematic [11, 12]. It has been reported that microsurgeries for medial temporal lobe glioma can be performed via various approaches, such as lateral fissure approach and trans-temporal approach. If an approach is unsuitable, it may cause damage to surrounding tissues in the brain [13]. Therefore, evaluating patient conditions reasonably and selecting the optimum approach is of great significance for successful surgery for medial temporal lobe glioma.

The lateral fissure approach is relatively safer, as it is an anterior approach which can significantly reduce damage to the visual radiation and its surrounding tissues and preserve the integrity of surrounding brain tissues. Nevertheless, the procedure is difficult to perform and great challenge to surgeons. In contrast, the trans-temporal approach is simple and has certain sensitivity to the extent of resection in the cerebral cortex. However, it causes greater damage to the cerebral cortex and tends to adversely impact patient eyesight. No reports so far have compared clinical outcomes of the lateral fissure approach and the trans-temporal approach to surgical resection for glioma of medial temporal lobes. Therefore, in this study, 92 patients with gliomas of medial temporal globes, admitted to Renmin Hospital, Hubei University of Medicine, were recruited as participants. They were randomly assigned to receive the lateral fissure approach or the trans-temporal approach. Surgical outcomes and postoperative complications of the two approaches were compared, with an aim to provide more clinical evidence for management of glioma of medial temporal lobes by surgical resections via different approaches.

Materials and methods

Participants

Between January 2014 and December 2017, a total of 92 patients with gliomas of medial temporal globes, admitted to Renmin Hospital, Hubei University of Medicine, were recruited into this study. Symptoms of patients were cooperatively confirmed by senior neurosurgeons and patients were randomly divided into an observation group and control group. Inclusion criteria: (1) Patients older than 18 years of age were eligible for enrollment if they presented with headache, malignancy, papilledema, tumor compression, and other symptoms which met the diagnostic criteria for brain glioma; (2) Malignancy rating to grade I-II, if demonstrated on imaging scans that tumors were located in the medial temporal globe region; (3) If their complete clinical data were available and they cooperated actively in the treatment; (4) If they had no severe metabolic disease involving the liver or the kidney; and (5) If they had no surgical contraindications or history of anesthetic allergies [14, 15]. Exclusion criteria: (1) Patients were excluded if they had comorbidities of intracranial disease including intracranial hemorrhage; (2) If they were pregnant or breast-feeding; and (3) If they had received immunotherapy or radiotherapy for gliomas of medial temporal globes in the previous three months. The Medical Ethics Committee of Renmin Hospital, Hubei University of Medicine, approved this study. All enrolled participants gave written informed consent.

Methods

All of the patients underwent routine brain CT and MRI examinations before surgery. Patients in the observation group underwent surgery via the lateral fissure approach. Under general intravenous anesthesia, craniotomy was performed on each patient to expose the lateral fissure and the arachnoid was incised open during microsurgery. When the cerebrospinal fluid in the arachnoid flowed out slowly, major vascular nerves in the lateral fissure were dissected bluntly with the ophthalmic forceps to fully expose the temporal horn and insula of lateral ventricle. Tissues in the lesion sites were determined and removed and care was taken to protect the surrounding tissues. Patients in the control group received craniotomy via the trans-temporal approach. Under general anesthesia, an incision was made in the temple of each patient. The diseased tissues in the superior temporal gyrus, the middle temporal gyrus, and the inferior temporal gyrus were dissected external to the temporal horn of the lateral ventricle. Care was taken to avoid excessive traction which could cause mechanical damage to the temporal lobes. Diseased tissues in the medial temporal lobe were observed and resected. Postoperatively, second-generation cephalosporin antibiotics were routinely administered for anti-inflammation and changes in patient consciousness and vital signs were observed closely. All patients were followed up

Table 1. Baseline characteristics of patients

Variables	Case	Age (year)	BMI (kg/m^2)	Male/Female	DC (year)	A/PMTL
Observation group	46	48.2±6.0	21.9±1.6	26/20	3.7±1.1	28/18
Control group	46	47.6±5.8	20.3±1.4	28/18	3.5±1.3	29/17
t/χ^2		0.522	0.412	0.179	0.841	0.046
P		0.301	0.341	0.672	0.201	0.830

Note: BMI, body mass index; DC, disease of course; A/PMTL, anterior/posterior medial temporal lobe.

Table 2. Clinical response to surgical resection for cerebral gliomas via alternative approaches (n, %)

Variables	Case	CR	PR	PD	Response rate
Observation group	46	15 (32.61%)	19 (41.30%)	12 (26.09%)	34 (73.91%)
Control group	46	11 (23.91%)	20 (43.48%)	15 (32.61%	31 (67.39%)
χ^2	-		0.974		0.472
P	-		0.614		0.492

Note: CR, complete response; PR, partial response; PD, progressive disease.

by means of outpatient appointments or telephone calls and received regular reviews by contrast-enhanced CT or MRI of the brain.

Outcome measures

Clinical response to treatment was compared between the two groups. The criteria for clinical response evaluation were as follows: lesion sites were observed on contrast-enhanced CT or MRI of the brain, within 24 to 48 hours after surgery, and reviewed at 3 months. Complete response (CR) was defined as disappearance of all target lesions. Partial response (PR) was defined as at least a 30% decrease in the sum of the longest diameter (LD) of target lesions. Progressive Disease (PD) was defined as at least a 30% increase in the sum of the LD of target lesions or appearance of new lesions. The formula for calculating the response rate to treatment was as follows: Response rate = (No. of CR cases + No. of PR cases) total No. of cases *100%. Improvement in clinical symptoms of patients at 1 year after surgery were compared between the two groups. Symptoms included headache, endocrine disorders, papilledema, and epilepsy. Quality of life (QoL) of patients in the two groups was assessed by means of the Oncology-specific health-related Quality of Life Scale (HRQoL) specified by the World Health Organization (WHO) [16]. The HRQoL scale comprises physical, psychological, environmental, and social domains, totaling 26 items. Scores of each item ranged from 1 to 5, with higher scores denoting better QoL. The extent of surgical resection of tumors and incidence of postoperative visual impairment were compared between the two groups. The extent of tumor resection included total resection, subtotal resection, and massive resection.

Statistical analysis

All data were analyzed with SPSS statistical software, version 20.0. Count data are presented as rates and Chi-square tests were used for comparisons between the two groups. Measurement data are described as mean ± sd and independent samples t-tests were employed for comparisons between the two groups. Paired t-tests were utilized for comparisons among more than two groups, before and after surgery, whereas independent sample t-tests were applied for inter-group comparisons at the same time points. $P<0.05$ was considered to be statistically significant.

Results

Baseline characteristics of patients

Patients in the observation group and control group were well-matched in gender, age, body mass index (BMI), course of disease, and sites of lesions (all $P>0.05$). They were comparable (**Table 1**).

Clinical response to surgical treatment

CR rate (32.61%) of the observation group was higher, though insignificantly, than that (23.91%) of the control group (P=0.354). This same pattern was noted in the PR rates of the two groups, with 73.91% in the observation group versus 67.39% in control group (P=0.492; **Table 2**).

Table 3. Improvement in clinical symptoms of patients (n, %)

Symptoms	Observation group	Control group	χ^2/P
Preoperative headache	41 (89.13%)	39 (84.78%)	1.050/0.306
Postoperative headache	3 (6.52%)	2 (4.35%)	0.213/0.645
χ^2/P	62.902/0.000	60.233/0.000	-
Preoperative endocrine disorder	33 (71.74%)	34 (73.91%)	0.074/0.786
Postoperative endocrine disorder	2 (4.35%)	1 (2.17%)	0.346/0.557
χ^2/P	44.317/0.000	50.220/0.000	-
Preoperative papilledema	38 (82.61%)	35 (76.09%)	0.942/0.332
Postoperative papilledema	3 (6.53%)	1 (2.17%)	1.050/0.306
χ^2/P	63.137/0.000	54.261/0.000	-
Preoperative epilepsy	36 (78.26%)	38 (82.61%)	0.454/0.500
Postoperative epilepsy	2 (4.35%)	2 (4.35%)	0.000/1
χ^2/P	56.271/0.000	65.512/0.000	-

Table 4. QoL of patients in the two groups (mean ± sd)

Variables	Quality of life score		t value	*P* value
	Preoperatively	Postoperatively		
Observation group	44.6±6.3	76.9±7.9	34.966	0.001
Control group	45.5±6.7	71.2±7.3	3.677	<0.001
t value	-0.241	1.678	-	-
P value	0.416	0.118	-	-

Table 5. Extent of surgical resection and operative complications of patients between two groups (n, %)

Variables	Total resection	Subtotal resection	Massive resection	Visual impairment
Observation group	22 (47.83%)	13 (28.26%)	7 (15.22%)	3 (6.52%)
Control group	23 (50.00%)	13 (28.26%)	6 (13.04%)	18 (39.13%)
χ^2 value		0.099		11.539
P value		0.952		0.001

Improvements in clinical symptoms

Clinical symptoms including headaches, endocrine disorders, papilledema, and epilepsy were insignificantly different between the two groups, before surgery (all P>0.05). At six months of follow up after surgery, clinical symptoms of both groups were remarkably improved than those before surgery (P<0.05) but improvement in postoperative clinical symptoms differed insignificantly between the two groups (P>0.05; **Table 3**).

Quality of life

There was no substantive disparity in preoperative QoL scores of patients between the two groups (P>0.05). Postoperative QoL was substantially improved in the two groups compared to before surgery (the observation group, P=0.001; the control group, P=0.000). The postoperative QoL score (76.9±7.9) in the observation group was higher, though slightly, than that (71.2±7.3) in the control group (t=1.678, P=0.118), as shown in in **Table 4**.

Extent of surgical resection and operative complications

There were no significant differences in extent of surgical resection between the two groups (P>0.05) and considerably lower incidence (6.52%) of postoperative visual impairment was seen in the observation group than (39.13%) in the control group (χ^2=11.539, P=0.001; **Table 5**).

Discussion

The major purposes of surgical treatment of cerebral gliomas are to confirm pathological diagnosis, reduce tumor volume, and relieve symptoms of intracranial hypertension. For gliomas of medial temporal lobes, surgical outcomes of different approaches vary greatly. Finding an appropriate surgical approach is clinically essential to reduce incidence of surgical complications in patients with glioma, achieving effective and safe treatment of glioma.

The lateral fissure approach has been shown to be more effective than trans-temporal approach to surgical treatment of medial temporal lobe glioma [17]. Another study has stated that the two surgical approaches differ in incidence of postoperative visual impairment; the trans-temporal approach was associated with significant reduction in incidence of postoperative visual impairment and potential fewer postoperative surgical complications in patients [18]. The results of this current study indicated that, after surgical resection via the two different surgical approaches, postoperative clinical symptoms of patients with medial temporal lobe gliomas were remarkably improved compared to those before surgery (P<0.05). However, incidence of postoperative clinical symptoms and QoL varied insignificantly between the two groups (both P>0.05). This might be attributable to the fact that patients in both groups underwent direct resection of lesions and postoperative recovery care which contributed to more substantive reductions in incidence of headache, endocrine disorders, papilledema, and epilepsy, than preoperatively. Nevertheless, there were no significant postoperative differences between the two groups, except a greater decrease in incidence of visual impairment in the observation group (P<0.05) [19, 20]. The cause may be due to the fact that the lateral fissure approach to surgical resection is an anterior approach and it is safer. This approach may significantly decrease damage to visual radiation and surrounding cerebral tissues and preserve the physiological functions of the lateral cortex of the temporal lobes. However, this approach to surgical resection is difficult to perform and might cause damage to the oculomotor nerves or blood vessels. Surgeons with rich anatomical knowledge and skilled techniques are required, accordingly. In contrast, the trans-temporal lobe approach allows more favorable exposal of the brain but it may cause damage to more parts of the brain (superior orbital gyrus and temporal gyrus) and greater injuries to the visual radiation and lateral temporal cortex [21, 22]. Clinical studies have demonstrated that the fissure approach is associated with fewer side effects and more effective clinical outcomes in treatment of medial temporal lobe gliomas. Additionally, in recent years, with increasing improvement in surgical instruments and advances in surgical techniques, surgical risks have been gradually reduced [23].

In conclusion, much attention should be paid to clinical symptoms, QoL, and postoperative complications in patients with glioma of medial temporal lobes. In this present study, after analyzing the lateral fissure approach and trans-temporal lobe approach to surgical resection in treatment of patients with glioma of medial temporal lobes, it was found that the lateral fissure approach is superior. Therefore, in clinical work, relevant surgeons should conduct a comprehensive assessment based on patient imaging results, choose reasonable surgical approaches, and make full preoperative preparations. The findings of this study provide more evidence for management of cerebral gliomas and give direction to future clinical surgeries. Hence, it is worthy of extensive use in a clinical setting. However, there are some limitations to this study. For example, the sample size was small, long-term clinical outcomes of patients could not be determined, and effects of different surgical approaches on high-grade temporal lobe glioma have not been elucidated. In future research, multi-center trials with long-term follow-ups and larger sample sizes are required for further validation.

Disclosure of conflict of interest

None.

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