MANAGEMENT OPTIONS FOR CEREBRAL GLIOMAS

Wael A.A. El-Mesallamy; Hamdy M. Farahat; Tarek H. Abdel Bary and Magdy E.H. Rashed
Neurosurgery Department, Faculty of Medicine, Zagazig University

ABSTRACT

Background: Cerebral gliomas are the most prevalent primary brain tumors in adult patients. **Objectives:** The purpose of this prospective study was evaluation of various management strategies including surgery facilitated by intraoperative ultrasonography, radiotherapy and chemotherapy with addressing impact of various factors on the outcome. **Patients and methods:** In a prospective evaluation, we studied 55 adult patients with primary cerebral gliomas who were operated upon at our department between January 2009 and January 2011 with follow up at least one year for survived patients. Radiotherapy was received postoperatively by 48 patients of whom 34 patients received chemotherapies. All clinical, radiological, imaging, pathological and management modality records were evaluated as prognostic factors. **Results:** The mean survival time was 13.7 months. We confirmed that the patient age, preoperative functional status (by Karnofesky scale), location of cerebral gliomas, size of gliomas, extent of resection, intraoperative ultrasonography use, grades of glioma and postoperative functional status as decisive prognostic factors and had an impact on outcome. **Conclusion:** We could show that young ages (≥ 16-40 years), high preoperative Karnofesky scores (≥ 80%), single-lobe involvement by glioma, small tumor size (≤ 5 cm), gross total resection, intraoperative ultrasonography use, low-grade gliomas and high postoperative Karnofesky scores (≥ 80%) were predictors for better outcome.

Keywords: cerebral glioma, survival, prognosis, outcome, intraoperative ultrasound

INTRODUCTION

Glial tumors are the most common types of primary brain neoplasms and constitute approximately 60% of all primary brain tumors[(1)].

There are three standard types of treatment for patients with glioma: surgery, radiation therapy and chemotherapy. Major centers may offer experimental treatments, while therapies for high grade gliomas are helpful. At present, these treatments cannot cure the tumors[(2)].

The tumor mass evaluated with the help of ultrasonography enhancing the surgeon feeling of safety and leading to greater confidence that the lesion was excised as completely as possible without disturbing adjacent viable tissue and thus avoiding new postoperative neurological deficits[(3)].

Several variables affect prognosis and therapy options of patients with cerebral gliomas as patient age, performance status, extent of resection, tumor size, tumor location, tumor grades, tumor biology and adjuvant therapies[(4)].

The aim of this study is evaluation of the results of various management strategies of adult patients with primary cerebral gliomas including surgery facilitated by intraoperative ultrasonography, radiotherapy and chemotherapy with addressing impact of the various factors on the outcome.

PATIENTS AND METHODS

A prospective study of 55 adult patients with cerebral glioma operated upon at Neurosurgery Department, Faculty of Medicine, Zagazig University between January 2009 to January 2011.

Patients with recurrent glioma, intraventricular glioma and ages < 16 years were excluded from this study. All patients were subjected to clinical, laboratory, radiological and imaging investigations before surgery under general anaesthesia for surgical resection.

Intraoperative ultrasonography was used during surgeries of 25 patients. RIBE-2500D digital ultrasound scanner with 5-8 MHz endocavitary probe was used for 15 patients and EUB-405 plus ultrasound scanner with 3-10 MHz convex probe was used for 10 patients. The probe was covered by a sterile glove and the ultrasound gel put inside the glove. The probe was used on the dura and then on the brain and the tumor to visualize the tumor location, characters, nearby brain landmarks, and resection monitoring. The real time mode was used and then the B-mode for doing the measurements, we firstly adjust the gain button which determines the grey-white compensation curve. So, the normal brain tissue is uniformly hypoechoic.

Postoperative assessment for the patients was done clinically and CT or MRI brain was done within 48 hours postoperatively for assessment of extent of resection and detection of surgical complications.

The extent of resection based on operative records and postoperative CT or MRI finding. Gross total resection was defined if the mass was removed totally. However, a subtotal resection was defined if ≥ 50% resection and partial resection if < 50% resection achieved.

Radiotherapy was given either by linear accelerator or cobalt machines for high grade glioma in dose of 60-65 Grays and for low grade glioma in dose of 54 Grays. Fractionation regimen used was 1.8-2 Grays/fraction for five days/week.

There were 48 patients treated postoperatively by radiotherapy.

The patients treated by chemotherapy divided into two groups; one received temozolamide (13 patients) and the another group received PCV regimen [Procarbazine, CCNU (Lomustin) and Vincristine] (21 patients).

Follow up of the patients was done for at least one year for survived patients. The frequencies of follow up were one week after hospital discharge, every one month during first 6 months and then every 3 months. Follow up was done if the patient complained at any time. During follow up, the patients subjected to CT brain or MRI brain especially at the end of adjuvant therapies and when the patient developed neurological manifestations.

The functional status was evaluated according to Karnofesky scale[5].

Patients with Karnofesky rating ≥ 80 were graded as independent, patients with rating 60-70 were graded as semidependent and patients with rating ≤ 50 were considered dependent[6].

All clinical, radiological, imaging, pathological and management modality records were evaluated as prognostic factors.

Statistical analysis:

Data were checked, tabulated and analyzed by using SPSS version 19. Data were expressed as mean for quantitative variable numbers and percentages for categorical variables. Chi-square, Fisher exact and student t tests were used when appropriate. $p < 0.05$ was considered statistically significant. Survival (till time of death) and tumor recurrence (progression-free survival) were measured from the date of surgery.

RESULTS

In table 1, the ages of the patients ranged from 17 to 77 years, the mean age was 43 years and the commonest age group was 30-40 years. There were 36 males (65.5%) and 19 females (34.5%) with male to female of 1.9:1. Gradual onset of symptoms was found in 65.5% of the patients , while acute onset by fits was found in 34.5%,progressive course was found in 78% and remission and exacerbation of only fits was found in 22% of the patients. The duration of symptoms ranged from 3 weeks to 8 years with mean of 11.4 months. The commonest symptom was headache in 78.2% of the patients and the commonest sign was papilloedema in 67.3%. Frontal lobe location was the predominant in 62.1% and tumor size ≤ 5 cm was found in 52.7%.

Pathological types were glioblastoma (WHO GIV) in 21 patients, anaplastic astrocytoma (GIII) in 15 patients, astrocytoma (GII) in 11 patients, pleomorphic xanthoastrocytoma (GII) in 3 patients, pilocytic astrocytoma (GI) in 2 patients, subependymal giant cell astrocytoma (GI) in one patient and mixed glioma in 2 patients; one with mixed anaplastic astrocytoma and oligodendroglioma (GIII) and one with pilocytic astrocytoma with focal oligodendroglioma (GII).

In table 2, Intraoperative Ultrasonography (IOUS) was used in 25/55 operations for surgical removal of primary cerebral glioma. The comparison with preoperative CT and MRI showed that the ultrasonography delineated the cystic components, necrotic components, calcification and perilesional oedema in all the tumors where present in preoperative investigations with more clearance of these components as there were septae inside some cysts were not clear in preoperative investigations. Tumor edges were more well-defined in ultrasonographic images (23/25, 92%), while well-defined tumor edges in preoperative investigations were 12/25, 48%) ($p < 0.05$, significant).

In this study, there was significant gross total resection ($p = 0.001$) in the cases with intraoperative ultrasonography use (figures 1-9) and significant partial resections in the cases without intraoperative ultrasonography use ($p = 0.001$).

In this study, the operative complications occurred in 19/55 patients (34.5%); of them two mortalities (3.6%) and 4 patients with major deficits (motor weakness, speech and cognitive deficits). There were no significant difference between the two groups (with IOUS use and without IOUS use) regarding the operative complication, while there were significant differences regarding severe operative complications (including mortalities and major deficits) in favour of use of intraoperative ultrasonography. No operative mortalities were found in IOUS group.

There were significant correlation between IOUS use and independent functional outcome and Karnofesky improvements.

In table 3, the mean survival was 13.7 months, the median survival was 12.5 months and one-year survival was 38/55 patients (69.1%). The operative mortalities (within 30 days after surgery) were 2/55 patients (3.6%).

By univariate analysis of different factors, in relation to postoperative Karnofesky score improvement, independent functional outcome, progression-free survival (till tumor recurrence) and one-year survival (till patient death), it was

found that all the variables studied affected the prognosis significantly except sex of the patients, tumor lateralization (right or left), type of lobe involvement (frontal or partial or temporal or occipital) and types of chemotherapy used.

The regression response of residual glioma after surgery to adjuvant therapies occurred in 12/34 patients (35.3%). The regression response to radiotherapy and chemotherapy occurred in 6/22 patients (27.3%) and to radiotherapy without chemotherapy in 6/12 patients (50%); we cannot compare the two groups as radiotherapy with chemotherapy were given mostly to patients with malignant gliomas (97% of this group with malignant gliomas), while radiotherapy without chemotherapy was given mostly to patients with benign gliomas (92.9%).

In this study, no significant difference between the patients received temozolamide chemotherapy and the patients received PCV chemotherapy regimen regarding regression response ($p = 0.03$).

Table (1): Characteristics of 55 patients with cerebral gliomas

Patient characteristics	No	%
Age		
≤ 40 years	26	47.3
> 40 years	29	52.7
Sex		
Males	36	65.5
Females	19	34.5
Onset of symptoms		
Gradual	36	65.5
Acute	19	34.5
Course of symptoms		
Progressive	43	78
Remission and exacerbation	12	22
Commonest symptoms		
Headache	43	78.2
Motor weakness	28	51
Epileptic fits	26	47.3
Commonest signs		
Papilloedema	37	67.3
Motor weakness	28	51
Preoperative Karnofesky scores		
80-90	16	29
60-70	24	43.6
≤ 50	15	27.2
Tumor lateralization		
Right	31	56.4
Left	22	40
Bilateral	2	3.6
Lobe involvement		
3 lobes	1	1.8
2 lobes	25	45.5
Single lobe	29	52.7
Frontal	18	62.1
Parietal	8	27.6
Temporal	2	6.9
Occipital	1	3.4
Tumor depth		
Cortical	36	65.5

Subcortical	19	34.5
Tumor size		
≤ 5 cm	29	52.7
> 5 cm	26	47.3
Extent of tumor resection		
Gross total	18	32.7
Subtotal	22	40
Partial	15	27.3
Tumor grades		
IV	21	38.2
III	16	29.1
II	15	27.3
I	3	5.5
Postoperative Karnofesky score		
≥ 80	30	54.5
60-70	19	34.5
≤ 50	6	10.9

Table (2): Intraoperative ultrasonography evaluation

Comparison items	p
Comparison to preoperative investigations (CT and/or MRI)	
Well-defined tumor edges	0.001
Comparison to the groups without IOUS use	
Gross total resection	0.001
Overall operative complications	> 0.05
Severe operative complications	0.046
Postoperative Karnofesky score improvement	0.001
Postoperative independent functional outcome	0.02

Table (3): Prognostic factors and results of univariate analysis of studied glioma patients

Variable	Karnofesky improvement p value	Independent functional outcome p value	Progression-free survival p value	One-year survival p value
Age	NS	-	-	-
≥ 16-40 years	-	0.015	0.001	0.02
> 40 years	-	-	-	-
Sex	NS	NS	NS	NS
Males	-	-	-	-
Females	-	-	-	-
Preoperative Karnofesky score	-	-	-	-
≥ 80	-	0.001	0.002	0.006
60-70	-	-	-	-
≤ 50	0.04	-	-	-
Tumor size	-	NS	-	-
≤ 5 cm	-	-	0.01	0.03
> 5 cm	-	-	-	-
Tumor lateralization	-	NS	NS	NS
Number of lobe involvement by glioma	-	-	-	-

3 lobes	-	-	-	-
2 lobes	-	-	-	-
Single	-	0.001	0.04	0.04
Type of lobe involvement by glioma	-	NS	NS	NS
Tumor relation to brain depth	-	NS	-	NS
Cortical	-	-	0.02	-
Subcortical	-	-	-	-
Extent of resection	-	-	-	-
Gross total	0.001	0.001	0.001	0.003
Subtotal	-	-	-	-
Partial	-	-	-	-
Intraoperative ultrasonography	-	-	NS	NS
Yes	0.001	0.02	-	-
No	-	-	-	-
WHO glioma grades	NS	-	-	-
High grades (IV, III)	-	-	-	-
Low grades (II, I)	-	0.002	0.001	0.001
Postoperative Karnofesky score	-	-	-	-
≥ 80	-	-	0.001	0.03
60-70	-	-	-	-
10-50	-	-	-	-
Chemotherapy	-	-	NS	NS
Temozolamide	-	-	-	-
PCV	-	-	-	-

Illustrative surgical removal by intraoperative ultrasound:

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Case 1:

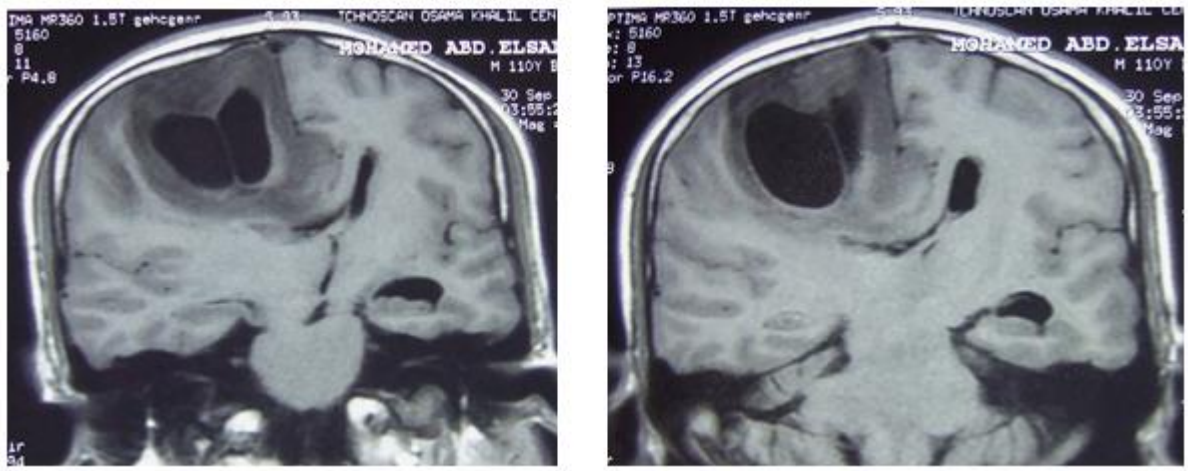

Figure (1): Preoperative T_1 MRI brain with contrast

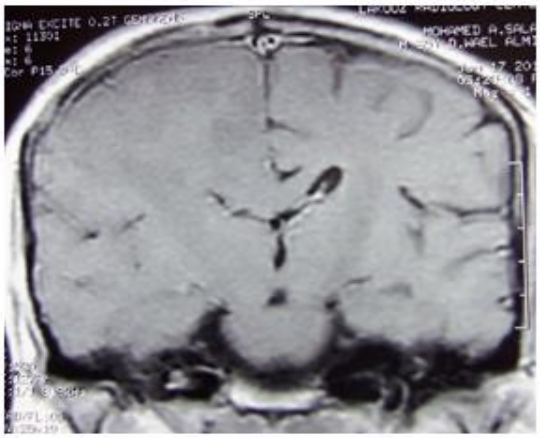

Figure (2): Postoperative T_1 MRI brain with contrast (total excision)

Figure (3): Intraoperative ultrasonography (tumor delineation)

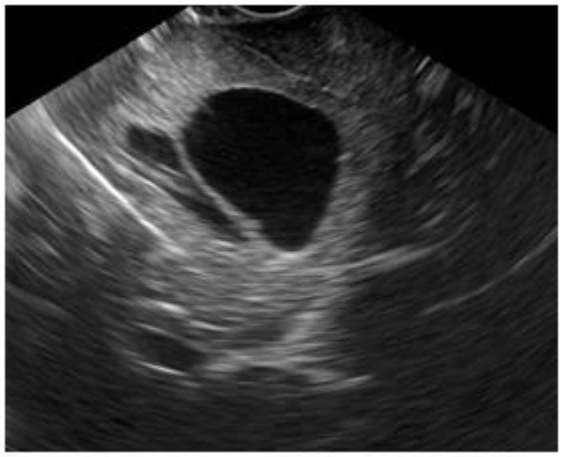

Figure (4): Intraoperative ultrasonography (tumor delineation)

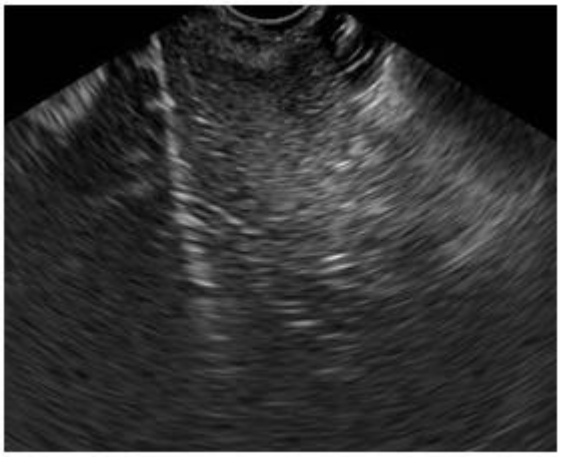

Figure (5): Intraoperative ultrasonography (gross total excision)

Case 2:

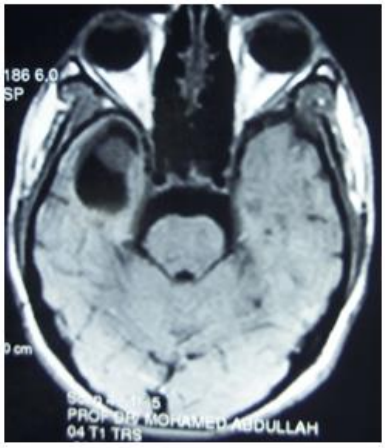

Figure (6): Preoperative T_1 MRI brain with contrast

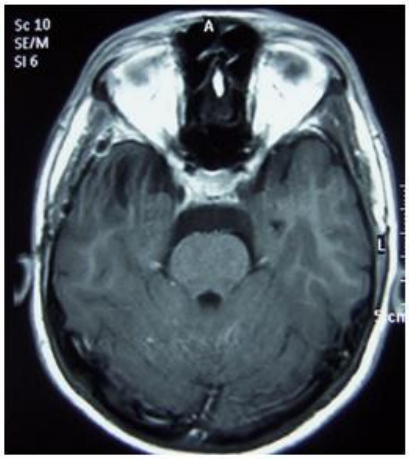

Figure (7): Postoperative T_1 MRI brain with contrast (total excision)

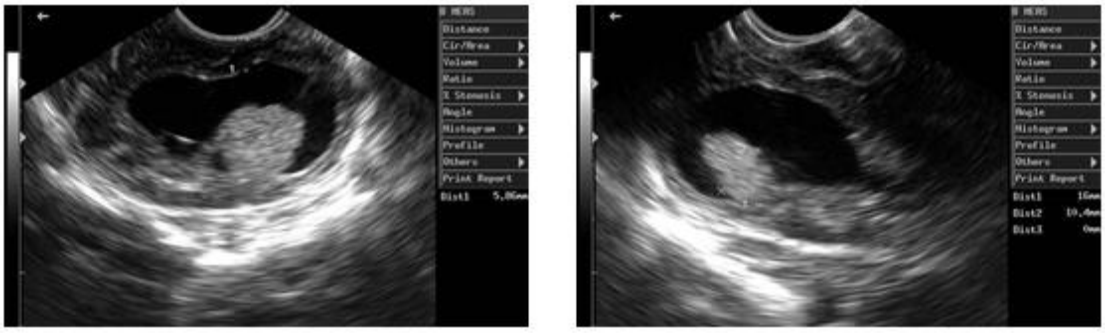

Figure (8): Intraoperative ultrasonography (tumor delineation)

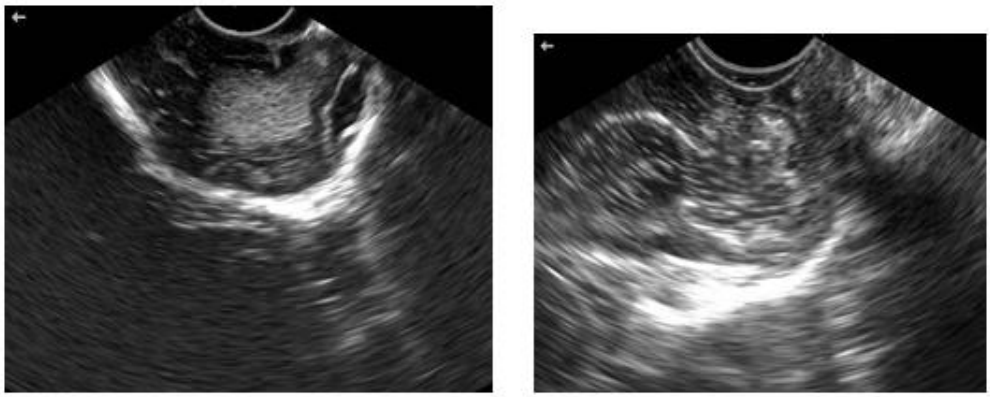

Figure (9): Intraoperative ultrasonography (resection monitoring with total excision)

DISCUSSION

The successful management of a patient with cerebral glioma depends upon a prompt and accurate diagnosis, careful preoperative planning, skillful tumor removal and good postoperative care.

In this study, the ages of the patients ranged from 17 to 77 years with mean age of 43 years. **Suvi et al.**[7] studied 331 adult patients with cerebral glioma and reported that the ages ranged from 20 to 69 years with mean of 49.2 years.

The male to female ratio in our study was 1.9:1. There is a male dominance in almost all incidence studies for glial tumors[8] and it was 1.8:1 in **Stephen et al.**[9] study on cerebral glioma.

In our study, the gradual onset and progressive course were the predominant presentation of our patients (65.5% and 78%) with duration of symptoms ranging from 3 weeks to 8 years.

Nasser et al.[10] reported gradual onset in 88.3%, **Tandon et al.**[11] reported progressive course in 94% and **Osama et al.**[12] reported duration of symptoms of 3 weeks to 10 years.

In this study, the commonest clinical presentation of cerebral gliomas were headache in 78.2% of the patients, papilloedema in 67.3%, motor weakness in 51% and epileptic fits in 47.3% of the patients.

Younes et al.[13] reported headache in 58.6%, motor weakness in 53.1% and seizures in 40.7% as the commonest presentations of cerebral gliomas.

Van[14] reported papilloedema in 60% of patients with cerebral gliomas.

In this study, unilateral glioma location was found in 96.4%, with single-lobe involvement in 52.7%. Frontal lobe location was the predominant (in 62.1% of the patients) and the superficial location in 65.5%.

Suvi et al.[7] reported unilateral location in 95.1%, one lobe location in 68% and frontal lobe location in 40%.

Houben et al.[15] reported superficial location in 60% of the patients. Cerebral gliomas as reviewed in a lot of studies tend to grow unilaterally superficially, involving a single lobe with predilection to frontal lobe (according to tissue volume).

In this study, tumor maximal dimension was ≤ 5 cm in 52.7% that was 48% in **Stefano et al.**[16] study and 57.3% in **Edward et al.**[17] study.

In this study, gross total resection achieved in 18/55 patients (32.7%), subtotal in 40% and partial in 27.3%.

Rajan et al.[18] reported gross total resection in 13.4%, subtotal in 36.6%, partial in 26.8% and biopsy in 23.2%,while **Lighton et al.**[19] reported gross total resection in 50.9%, subtotal in 13.8% and partial in 35%.

The cerebral gliomas in adult patients showed different pathological types and grades with glioblastoma (WHO GIV) was the commonest types in all reviewed studies. Glioblastoma accounted 38.2% of glioma in our study, 46.5% in **Younes et al.**[13] study, 47% in **Suvi et al.**[7] study and 72% in **Stefano et al.**[16] study.

In this study, IOUS was used in 25/55 operations. The comparison with preoperative MRI and CT showed that the ultrasonography delineated the cystic component, necrotic component, calcification and perilesional oedema in all tumors when present in preoperative investigations with more clearance of these components as there were some septae inside some cysts and not clear in preoperative investigations. Tumor edges were more well-defined in ultrasonographic images (23/25, 92%), while well-defined preoperative investigations were 12/25 (48%) ($p < 0.05$, significant). These results were matched with a lot of studies as **Auer and van Velthoven**[20] who reported that ultrasonography gave a more accurate image of the situation than preoperative CT.

Hammoud et al.[21] reported that IOUS provided good delineation of tumor border in 83% of the primary glioma which is better, than MRI information. These also documented in **Koivukangas et al.**[22] study.

In this study, there were significant gross total resections with IOUS use which achieved in 52% of the tumors. These were matched with several studies as **Le Roux et al.**[23]**; Bernstein et al.**[24] **and Jani**[25]. **Wang et al.**[26] reported gross total resection in 71.4%.

In this study, there was statistically insignificant difference between the group operated with IOUS use and the group operated without IOUS use regarding operative complications, but there was significant difference between the two groups regarding severe complications in favour of IOUS use. These results were matched with **Wang et al.**[26] study.

In this study, there were statistically significant correlations between IOUS use and Karnofesky score improvement and independent functional outcome. These results were documented by several studies as **Wang et al.**[26]**; Ole et al.**[27] **and Jakola et al.**[28] studies.

The mean survival duration in this study was 13.7 months, median survival was 12.5 months and one-year survival was 69.1% of the patients.

Ibrahim et al.[29] reported median survival of 13 months, **Younes et al.**[13] reported one-year survival of 67% and **Wang et al.**[30] reported one-year survival of 69% of the patients.

In this study, operative mortalities were 3.6% (2 cases) and morbidities were 30.9% (17 cases). **Fadul et al.**[31] reported 3.3% mortalities and 31.7% morbidities.

Edward et al.[32] reported 5.6% mortalities and 9.4% morbidities.

In this study, there were 52.4% improvement of preoperative morbidities and 76.5% improvement of postoperative morbidities.

Nobuhiro and Susumu[33] reported 65% improvement of preoperative morbidities and 75.9% improvement of postoperative morbidities.

In this study, several factors were found to have a statistically significant better prognosis and matched the data from several studies on adult patients with cerebral gliomas:

1- Young ages ≤ 40 years.

2- Preoperative Karnofesky scores ≥ 80.

3- Single-lobe involvement and superficial (cortical) glioma location.

4- Small tumor size (≤ 5 cm maximal dimension).

5- Gross total resection.
6- Low-grade gliomas.
7- Postoperative Karnofesky score ≥ 80.
8- Intraoperative ultrasonography use[26, 28, 34, 35].
[13, 29, 36, 37, 38, 39, 40, 41, 42, 43]

In this study, the patient sex (male or female) did not affect the prognosis and this was agreed in several studies as **Younes et al.**[13], **Ibrahim et al.**[29], **Chaiyot and Yot**[39] studies.

In this study, there were no significant differences between the patient group treated by tenozolamide chemotherapy and the group treated by PCV chemotherapy regarding survival, progression-free survival and tumor regression response. These results were documented in meta-analysis of **Martin et al.**[44] **and Ben**[45] and study of **Siow et al.**[46].

In this study, the regression response of residual glioma (after surgery) to radiochemotherapy was 6/22 patients (27.3%), to radiotherapy without chemotherapy was 6/12 patients (50%) and overall regression was 12/34 patients (35.3%).

Patients receiving radiochemotherapy were mostly with high-grade gliomas and patients receiving radiotherapy without chemotherapy were mostly with low-grade glioma.

Lunsford et al.[47] reported regression response to incompletely resected low-grade gliomas after radiotherapy (46%) and **Glenn et al.**[48] found the response 52%.

Martin et al.[44] found the regression response of high-grade gliomas to radiochemotherapy varied between studies from 13.6% to 35%.

CONCLUSION

Cerebral glioma is a devastating disease especially high grades and extensive researches still in need for approaching the solution.

In our study, the prognostic factors of cerebral gliomas were: young age, high preoperative Karnofesky score ≥ 80, single-lobe location of glioma, superficial location, small tumor size ≤ 5 cm, gross total resection, intraoperative ultrasonography use, low-grade glioma and high postoperative Karnofesky scores ≥ 80.

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طرق علاج الأورام المخية الدبقية

وائل عبد الرحمن على المسلمى، د/ حمدى مرسى فرحات، د/ طارق حسن عبد البارى،
د/ مجدى السيد حسن راشد
قسم جراحة المخ والأعصاب- كلية الطب- جامعة الزقازيق

أجريت هذه الدراسة بقسم جراحة المخ والأعصاب جامعة الزقازيق على ٥٥ مريض أعمارهم أكثر من أو تساوى ١٦ عام يعانون من أورام دبقية بنصفى الكرة المخية وقد أجريت لهم الجراحة فى الفترة ما بين يناير ٢٠٠٩ الى يناير ٢٠١١ مع متابعة لمرض الناجين لمدة عام على الأقل .

تهدف هذه الدراسة الى تقييم طرق العلاج المختلفة لهذه الأورام وتأثير العوامل المختلفة على نتائج العلاج .

تعتبر الأورام الدبقية أكثر الأورام الأولية حدوثاً بنصفى الكرة المخية. تحدث الأورام الدبقية فى أى سن وقد تحدث فى الذكور أو الإناث ، فى هذه الدراسة تراوحت الأعمار ما بين ١٧ عام إلى ٧٧ عام وكان متوسط الأعمار ٤٣ عام وكانت النسبة ما بين الذكور والإناث ١٠٩ : ١ .

لاتوجد صفات إكلينيكة محددة تميز الأورام الدبقية بنصفى الكرة المخية ، فى هذه الدراسة كانت الأعراض الأكثر شيوعاً هى الصداع فى ٧٨.٢% من المرضى والضعف الحركى العضلى فى ٥١% من المرضى . الأعراض الناتجة عن الأورام الدبقية بنصفى الكرة المخية كانت تدريجية الظهور فى ٦٥.٥% وتراوحت فترات الشكوى قبل التشخيص ما بين ثلاثة أسابيع الى ثمانية أعوام.

فى هذه الدراسة وجدت الأورام الدبقية من الدرجة الرابعة فى ٢١ مريض والدرجة الثالثة فى ١٦ مريض والدرجة الثانية فى ١٥ مريض والدرجة الأولى فى ثلاثة مرضى . لايزال علاج الأورام الدبقية محل بحث وهناك ثلاثة طرق أساسية للعلاج وهى العلاج الجراحى والعلاج بالذرة (الاشعاعى) والعلاج الكيماوى .

فى هذه الدراسة تم استخدام جهاز الموجات فوق الصوتية أثناء استئصال ٢٥ ورم دبقى وتم استخدام العلاج الاشعاعى بعد الجراحة لعلاج ٤٨ مريض وكذلك العلاج الكيماوى لعلاج ٣٤ مريض .

تم استئصال كلى للأورام الدبقية فى هذه الدراسة لعدد ١٨ مريض وتحت الكلى لعدد ٢٢ مريض وجزئى لعدد ١٥ مريض ، حدثت مضاعفات للمرضى أثناء الجراحة لعدد ١٩ مريض منهم حالتين وفاة وتم شفاء ١٣ مريض من هذه المضاعفات .

أظهر استخدام جهاز الموجات فوق الصوتية فى هذه الدراسة قدرة فائقة على إظهار معالم الورم أثناء الجراحة وتعتبر أفضل من إظهار معالم الورم فى الفحوصات السابقة للجراحة من أشعة مقطعية أو رنين مغناطيسى .

ومقارنة بالجراحات التى لم يتم استخدام جهاز الموجات فوق الصوتية فقد اظهر استخدام الجهاز أثناء الجراحة علاقة ذات دلالة إحصائية بالقدرة على الاستئصال الكلى للاورام وقلة حدوث المضاعفات الخطيرة بسبب الجراحة وكبر مدى التحسن الوظيفى للمرضى بعد الجراحة بمقياس كارنوفسكى .

طبقا لأهداف هذه الدراسة تم محاولة التوصل الى العوامل التى تؤثر على نتائج علاج الأورام الدبقية بنصفى الكرة المخية وبعد البحث فى المراجع والأبحاث العلمية المختلفة ودراسة الحالات التى شملتها هذه الدراسة وجدنا أن عوامل ذات دلالة إحصائية للنتائج الأفضل:

١- المرضى الذين تقل أعمارهم عن ٤٠ عام.
٢- المرضى ذو الدرجات الوظيفية ٨٠% فأكثر بمقياس كارنوفسكى قبل إجراء العملية.
٣- تواجد الورم بفص واحد بالمخ.
٤- تواجد الورم السطحى بالقشرة المخية.
٥- الأورام التى قطرها ٥ سنتيمترات أو أقل.
٦- الاستئصال الكامل للأورام.
٧- استخدام جهاز الموجات فوق الصوتية أثناء الجراحة.
٨- الأورام الحميدة.
٩- المرضى ذو الدرجات الوظيفية ٨٠% فأكثر بمقياس كارنوفسكى بعد إجراء الجراحة.

على الرغم من حدوث تطور كبير فى علاج الأورام الدبقية إلا انه حتى الآن لم يوجد علاج قاطع خاصة للأنواع الخبيثة وتحدى الغد أن نحاول وإن لم نستطيع كشف الغموض القائم حول الأورام الدبقية .