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Clinical Investigation

Body Mass Index as a Prognostic Marker in Glioblastoma Multiforme: A Clinical Outcome

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Summary

This study deals with the important subject of obesity and its impact on survival in glioblastoma patients. This is a single institution retrospective study with a fairly large sample size (392 patients), treated on a uniform protocol with a long-term follow-up. Elevated BMI patients appear to have a better survival.

Purpose: Correlation of body mass index (BMI) with clinical outcome in patients with glioblastoma is not well documented. Hence, we studied the association between survival and pretreatment BMI in glioblastoma patients.

Methods and Materials: In this retrospective study, only patients with histopathology-confirmed glioblastoma were included. Their BMIs were calculated from height and weight measurements and recorded in medical records at their first examination. Treatment plans for all patients consisted of concurrent radiation therapy and temozolomide, followed by maintenance therapy with temozolomide. The primary endpoint was overall survival (OS). Univariate and multivariate Cox proportional hazards models were used to estimate the mortality risk associated with BMI as a continuous and categorical variable. A BMI of 18.5 to 24.9 kg/m^2 was classified as normal, 25.0 to 29.9 kg/m^2 as overweight, and $\geq$30.0 kg/m^2 as obese.

Results: Data from 392 patients treated from January 2008 through June 2016 were analyzed. At a median follow-up of 48.6 months, the median OS was 13.5 months in normal subjects, 15.4 months in overweight subjects, and 15.1 months in obese subjects. A total of 81% of the patients died. The hazard ratios for overweight and obese patients were 0.70 (95% confidence interval, 0.54-0.92; $P = .009$) and 0.66 (95% confidence interval, 0.45-0.98; $P = .04$), respectively, when adjusted for age, Karnofsky performance score, and extent of resection. Sex, diabetes, and hypertension had no significant interactions.

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Conclusions: Patients with elevated BMIs had significantly better OS in our series of patients. The mechanism of this interaction needs to be explored further to understand this association.

Introduction

Body mass index (BMI) is a simple surrogate for measuring the approximate adiposity in the human body. The association between obesity and all-cause mortality is complex. A few studies suggest that being overweight confers either a small benefit or a negligible effect on mortality (1, 2), whereas other studies report a small increased risk (3). In the present study, we examined the impact of BMI on overall survival (OS) and BMI as a useful prognostic marker in patients with glioblastoma multiforme (GBM).

Methods and Materials

Medical records of 392 patients treated between January 2008 and June 2016 in our center were retrospectively analyzed. Follow-up data were available until the end of September 2017, by which time, 80.9% patients had died. All patients underwent standard treatment for GBM, consisting of maximal safe surgical resection, concurrent radiation therapy plus temozolomide, followed by 6 cycles of adjuvant temozolomide (4). Surgery was categorized as biopsy (<10% resected), subtotal resection (10%−90% resected), and gross total resection (>90% resected). Height and weight measurements of patients recorded at the time of first admission were used for calculating BMI.

Statistical analysis was performed using SPSS version 20 software (SPSS Statistics). Kaplan-Meier analysis was performed to compute OS by using the log-rank test. Survival duration was calculated from the date of surgery to the date of death from any cause or date of last contact. Univariate and multivariate Cox proportional hazards models were used to estimate hazard ratios (HRs) and 95% confidence intervals (CIs). The primary endpoint was OS, and a P value less than .05 was considered statistically significant.

Table 1 Baseline characteristics of 392 patients with newly diagnosed histopathologically confirmed glioblastoma multiforme

Prognostic factor	Number of patients	Percentage of patients	Median	Range	Number of events*	Percentage of events
Age						
18-54 (y)	156	39.8	56.0	64.0 (18-82)	127	81.4
≥55 (y)	236	60.2			190	80.5
Sex						
Males	269	68.6			218	81.0
Females	123	31.4			99	80.5
Karnofsky performance score						
≥80	134	34.2			107	79.9
≥60 and <80	149	38.0			124	83.2
≥40 and <60	109	27.8			86	78.9
Body mass index (kg/m^2)						
18.5-24.9	209	53.3	24.3	26.9 (16.6-43.5)	175	83.7
25.0-29.9	143	36.5			110	76.9
≥30.0	40	10.2			32	80.0
Recursive partitioning analysis						
Class 3	44	10.8			32	72.7
Class 4	183	46.7			152	83.1
Classes 5 and 6	165	42.1			133	80.6
Diabetes						
Nondiabetic	287	73.2			231	80.5
Diabetic	105	26.8			86	81.9
Hypertension						
Nonhypertensive	264	67.3			217	82.2
Hypertensive	128	32.7			100	78.1
Extent of resection						
Biopsies	69	17.6			53	76.8
Subtotal	157	40.1			131	83.4
Gross total	166	42.3			133	80.1

* The term "event" refers to death.