with inferior overall survival. Gender, country of birth, smoking status and diabetes did not significantly impact on survival. Multivariate analysis showed that age, clinical trial participation, IRSAD score and ECOG performance status were all independent predictors for overall survival.
Conclusions: This is the first study to demonstrate a profound effect of clinical trial participation, regardless of treatment arm and independent of age and performance status; and socio-economic status on survival in patients with GBM. The reasons why more socio-economically disadvantaged patients have shorter survival is unknown. These are novel and intriguing findings that require further exploration and could be used to help inform and improve best clinical management of patients with GBM.

8717 POSTER

Application of IMRT Technique in Treatment of Malignant Gliomas. Assessment of Treatment Tolerance

A. Mucha-Malecka[1], A. Sladowska[2], K. Malecki[3], B. Glinski[3]. [1]*Center of Oncology, Head and Neck Oncology, Krakow, Poland;* [2]*Center of Oncology, Department of Oncology, Krakow, Poland;* [3]*Center of Oncology, Head and Neck Oncology, Krakow, Poland*

Background: Assessment of tolerance of combined modality therapy of patients with malignant gliomas irradiated using IMRT technique. We compared dose distribution in IMRT and conformal 3D treatment plans.
Materials and Methods: Between 2009 and 2010 in the Oncology Center in Krakow 17 patients with malignant gliomas received combined modality treatment. Mean age was 53 years (range 28−66 years). All patients were in good performance status (WHO 0−1). There were 15 patients with glioblastoma multiforme and 2 with anaplastic astrycytoma. Ten patients underwent complete resection and 7 partial resection. Patient were irradiated using IMRT technique with a total dose of 60 Gy in 30 fractions. All patients concurrently received temozolamide in the dose of 75 mg/m^2. In all patients we performed additional plans using 3D conformal radiotherapy (3D-CRT) techniques and compared with IMRT plans. The 3D-CRT plans were prepared using 3−4 fields and IMRT plans consisted of 7−8 fields. The primary objective was to treat the planning target volume and to minimize the dose to organs at risk (OAR). Volumetric analysis, target coverage and conformity of prescribed doses were used in plan comparison.
Results: Treatment tolerance was vary good in all patients. Only 4 patients needed steroids during treatment. Adjustment of the dose distribution to the target volume was improved and the critical structures were better spared in the IMRT plans than in 3D-CRT plans. For all patients the mean dose and the maximum dose to OAR were significantly reduced in IMRT plans. With respect to target volume, IMRT technique reduced the maximum dose while increasing the minimum dose, resulting in improved conformity. In same patients with tumours located very close to OAR it was impossible to give 60 Gy for target volume with 3D-CRT technique because of not acceptable doses in OAR.
Conclusions: The IMRT technique combined with concurrent temozolamide is well tolerated and offers significant advantages comparing to 3D-CRT. Application of IMRT allows dose reduction at OAR without compromising target coverage.

8718 POSTER

Influence of Presenting Symptoms on Treatment Patterns and Outcomes in Glioblastoma Multiforme (GBM)

M. Teo[1], L. Connell[1], D. Graham[1], C. Drake[1], P. O'Dea[1], C. Keohane[2], S.P. O'Reilly[1], E.J. Moylan[1], D.G. Power[1]. [1]*Cork University Hospital, Department of Medical Oncology, Cork, Ireland;* [2]*Cork University Hospital, Department of Neuropathology, Cork, Ireland*

Introduction: GBM is an aggressive disease with poor outcome despite multi-modality treatment. Presentation is highly variable, ranging from neurological deficits and seizures to generalised symptoms of raised intracranial pressure such as headaches. We sought to review presenting symptomatology of GBM in a neuro-oncology referral centre, and the potential influence on management and outcome.
Methods: A prospectively maintained institutional database was reviewed to identify patients (pts)with diagnosis of GBM. Cliniopathologic data were analysed. Presenting symptoms were stratified into: neurological deficit (Def), headaches (HA) or seizures (Seiz), and one, two or three symptoms. Debulking and optimal adjuvant therapy rates were compared with chi^2 test, overall survival was compared with log-rank test method. Comparisons were made across stratified groups, e.g. HA vs no HA.
Results: Between Sept 2004 and Dec 2009, 121 evaluable pts were identified. Median age at diagnosis was 59 years (range 18−76) and 74% (n = 90) of pts were males. Common sites of tumours were parietal (28%), frontal (22%) and temporal (21%) lobes, with left hemisphere predominance (51%). In total, 81 pts (67%) presented with one symptom: neurological Def 46 (38%), HA 22 (18%) and Seiz 13 (11%), while 40 (33%) presented with two symptoms: Def + HA 27 (22%), Def + Seiz 10 (8%) and HA + Seiz 3 (2%). No pts had all 3 symptoms at presentation. Comparing pts with 1 vs 2 symptoms, rates of debulking were 65.4 vs 67.5%, p = 0.84 and rates of optimal therapy were 64.2 vs 60%, p = 0.69 [4 and 2 pts were not treated, respectively − see Table]. Hazard ratio for overall survival between groups was 0.71 (CI 0.49–1.34, p = 0.08). 52 pts (43%) had HA at presentation. Debulking (71 vs 62%, p = 0.39) and optimal treatment rates (62 vs 65%, p = 0.71) were similar. HR for overall survival was 1.08, p = 0.69.
Conclusion: Our data shows that the majority of pts (81%) with GBM presented with at least 1 symptom, neurologic Def being the most common. We have also shown that presenting symptoms have no significant influence on management or outcome. Time from onset of symptoms to diagnosis may be a confounder, however, as treatment may be instituted earlier. We intend to examine this.

	Debulked	%	Optimal Adjuvant Tx	%	Suboptimal Adjuvant Tx	%	No Adjuvant Tx	%	Total
HA	14	64	15	68	6	27	1	5	22
Def	29	63	30	65	14	30	2	4	46
Seiz	10	77	7	54	5	38	1	8	13
	53	65	52	64	25	31	4	5	81
Def + HA	22	81	16	59	10	37	1	4	27
Def + Seiz	4	40	6	60	4	40	0	0	10
HA + Seiz	1	33	2	67	0	0	1	33	3
	27	68	24	60	14	35	2	5	40

8719 POSTER

Long-term Follow-up in Adult Patients With Low-grade Glioma (WHO II) Postoperatively Irradiated. Analysis of Prognostic Factors

A. Mucha-Malecka[1], B. Glinski[1], K. Malecki[1], M. Jarosz[1], M. Hetnal[1], P. Dymek[1], A. Chrostowska[1]. [1]*Center of Oncology, Head and Neck Oncology, Krakow, Poland*

Background: There is little consensus about the optimal treatment for low-grade glioma (LGG), and the clinical management of LGG is one of the most controversial areas in neurooncology. Radiation therapy is one option for treatment of patients with LGG whereas other options include postoperative observation. The aim of this study is to report the long-term follow-up of a cohort of adult patients with LGG post-operatively irradiated in one institution, and to identify prognostic factors for progression free survival.
Material and Methods: Between 1975 and 2005, 180 patients with LGG (WHO II) received postoperative irradiation after non radical (subtotal or partial) excision. Patients had to be 18 years of age or older, and have histologic proof of supratentorial fibrillary (FA), protoplasmic (PA) or gemistocytic astrocytoma (GA). Radiotherapy was given within 3 to 10 weeks after surgery. The treatment fields were localized and included the preoperative tumour volume, with a 1−2 cm margin, treated to a total dose of 50 to 60 Gy in 25 to 30 fractions over 5 to 6 weeks.
Results: Actuarial ten- year progression free survival (APFS) in the whole group was 19%. The worse prognosis was reserved for patients with GA. Ten-year APFS rates for GA, PA and FA were 10%, 18% and 22% respectively.
Conclusion: The findings from our long-term cohort of 180 patients with LGG confirmed by uni- and multivariate analysis demonstrated that only astrocytoma histology significantly determined the prognosis. The best survival is reserved for patients with the fibrillary variant, and the worst for the gemistocytic one.

8720 POSTER

Positive Osteopontin Expression in High Grade Gliomas Predicts Poor Prognosis

P. Erpolat[1], P. Uyar Gocun[2], M. Akmansu[1], G. Ozgun[2], G. Akyol[2]. [1]*Gazi University Medical Faculty, Radiation Oncology, Ankara, Turkey;* [2]*Gazi University Medical Faculty, Pathology, Ankara, Turkey*

Background: Hypoxia associated proteins are of particular interest because of recent advances in targeted therapy. High expressions of hypoxia-inducible factor-1α (HIF-1α) and carbonic anhydrase IX (CA IX) appear to be strong prognostic indicator in many malignancies, however their role is unclear in high grade gliomas. Moreover, one of the other novel hypoxia-regulated molecule-osteopontin (OPN)-may play a role in high grade gliomas and may provide further therapy options. We performed an immunohistochemical analysis of OPN, HIF-1α and CA IX and correlated their expression levels with patient survival.
Material and Methods: A total of 92 (40 female, 52 male) patients with WHO grade 3 (n = 19) and grade 4 (n = 73) were included in the study. The median age was 49 (18−77) years. Gross total resection had

applied to 66%; subtotal resection had applied to 34% of the patients. The patients received radiotherapy (median 60 Gy in 2 Gy fraction dose) or radiochemotherapy. The evaluation of tumour specimens was performed by immunohistochemically of 92, 62 and 59 patients for OPN, CA IX, and HIF-1α, consecutively. The expression was determined by assessing the percentage of positive tumour cells (1−10%=1+, 11−49%=2+, ⩾50%=3+) and the staining intensity (weak=1+, moderate=2+, intensive=3+). Immunoreactive score (IRS) ranging from 0 to 9, was calculated by multiplying positive percentage and intensity scores. The markers were considered as positive staining when the IRS was ⩾1.
Results: OPN, CAIX and HIF-1α immunopositivity were found in 43.5%, 81% and 71% of the patients. The positive expression of OPN showed correlation with high recursive partitioning analysis classification (RPA: ⩽4 vs >4, p = 0.017), high tumour grade (3 vs 4; p = 0.006) and positive HIF-1α expression (p = 0.048). In univariate analysis, positive staining of OPN (p = 0.007) and CAIX (p = 0.008) with >50 years of age, karnofsky performance status ⩽70, grade 4, RPA ⩽4, subtotal surgical excision, presence of residive disease had negative impact on overall survival. In multivariate survival analysis, positive OPN expression (p = 0.009), >50 years of age and ⩽70 performance status were found as significant prognostic variables.
Conclusions: Our results suggest that OPN expression may be used as a prognostic indicator and it may also be a promising target molecule for hypoxia-directed treatment approaches for malign gliomas. However, further studies are needed to confirm our results.

8721 POSTER

Treatment of Cerebral Glioblastoma in Elderly Patients

M. Caroli[1], I.G. Vetrano[1], F. Lucarella[1], A. Di Cristofori[1], M. Pluderi[1], S.M. Gaini[1]. [1]*Fondazione IRCCS Cà Granda − Ospedale Maggiore Policlinico, Neurosurgery − Department of Neurological Sciences, Milano, Italy*

Background: The management of elderly patients with glioblastoma (GBM) is controversial, and benefits versus side effects of adjuvant treatments remain debated. We analyzed our series of high-grade gliomas in the elderly, who received adjuvant therapy after surgery.
Materials and Methods: A total of 62 patients older than 70 years were treated for malignant gliomas at our institution between 2005 and 2010. Forty patients (65%) were male and 22 (35%) female. The median age was 73 years (range 70−78). All patients showed a good performance status (KPS ⩾ 70).
Results: GBM was histologically proven in all cases. Forty-seven patients (75%) achieved a gross-total resection; 8 (13%) a subtotal one, according to post-operatives MRI scans. Biopsy was carried out in 7 (12%) patients. Among 62 patients, 45 (75%) received radiotherapy (RT) plus adjuvant Temozolomide (TMZ), 9 (13%) underwent RT alone, and 8 (13%) received only adjuvant TMZ. Between the group that received RT plus adjuvant TMZ, 12 patients had conventional RT of 60 Gy according to Stupp protocol (TMZ 75 mg/m^2 in the concomitant phase, and TMZ at the dose of 150 mg/m^2 for 5 days every month for at least 6 cycles). Thirty-tree patients received a short-course RT of 45 Gy, with 3 fraction/day at 2.5 Gy per 3 consecutive days (22.5 Gy total), associated to concomitant TMZ at the dose of 150 mg/m^2 for 5 days. A second cycle of hypofractionated RT and concomitant TMZ is repeated after 28 days from the first one, followed by at least 6 cycles of TMZ in the adjuvant setting.
Three patients submitted to the Stupp protocol stopped the therapy due to severe thrombocytopenia (1) and pneumonia (2). The median OS for patients who underwent TMZ plus RT (including both conventional and hypofractionated schedule) was 11.6 months (range 4−53). The median survival for patients who underwent RT only was 7.8 months, and for patients who had chemotherapy alone was 8 months. No significant difference was observed between the Stupp subgroup versus hypofractionated RT one in terms of survival.
Conclusions: RT plus concomitant chemotherapy could be considered an effective treatment in elderly patients with a good performance status. This combined approach proved a better overall survival compared to patients who receive radiotherapy or TMZ alone. Hypofractionated RT schedule allows the RT doses to be delivered over a shorter period of time, minimizing the side effects on patients, with a better quality of residual life.

8722 POSTER

Stereotactic Radiotherapy of Meningiomas − a Long-term Follow-up Study With Regard to Local Control, Survival and Morbidity

I. Compter[1], K. Zaugg[2], S.L. de Kunder[1], R.M.A. Houben[1], J.T.A. Dings[3], G. Bosmans[1], C. Buescher[2], B.G. Baumert[1]. [1]*Maastricht University Medical Centre (MUMC), Department of Radiation-Oncology (MAASTRO), Maastricht, The Netherlands;* [2]*University Hospital Zurich, Clinic and Policlinic of Radiation-Oncology, Zurich, Switzerland;* [3]*Maastricht University Medical Centre (MUMC), Department of Neurosurgery, Maastricht, The Netherlands*

Background: To analyze the long-term results in terms of efficacy of patients with a meningioma treated with fractionated stereotactic radiotherapy (SCRT).
Patients and Methods: Seventy-two patients treated with fractionated stereotactic radiotherapy between 1996 and 2008 at MAASTRO clinic (n = 45) and in Zurich (UHZ) (n = 27) were included. Patients received SCRT either as primary treatment (n = 46), as an adjuvant therapy following a subtotal resection (n = 19) or for recurrent tumours after a complete primary resection (n = 7). 49 of 72 tumours (68%) (21 UHZ, 28 MAASTRO) were located in the skull base region (cavernous sinus and pontine angle). The mean planning target volume was 31.0 ml (range 3- 115 ml). The median total dose was 54 Gy (range 50.4–59.4 Gy). Follow-up examination included MR-imaging and clinical work-up. Radiological control was defined as either complete response, partial response or stable disease. Data were analyzed using the Kaplan–Meier method.
Results: The median follow up was 4.13 years (range 0.66−11 years). Overall survival for patients with a WHO grade I and II meningioma was 92% and 75% at 3 years and 79% and 75% at 5 years, respectively. Progression-free survival for benign (grade I) meningiomas was 95% at 3 years and 95% at 5 years, and 40% for atypical meningiomas at 3 years. 98.4% of patients had either stable or improved (51.6%) clinical symptoms after radiotherapy. The majority of symptoms improved within 24 months after radiotherapy. Local control is significantly better if patients are irradiated immediately i.e. within three months after diagnosis compared to a watchful waiting policy (p = 0.017). Local control was significantly different between centres (p = 0.006/UHZ 70.4%, MAASTRO 95.3%), where in subgroup analyses only planning tumour volume (PTV) (p = 0.011/UHZ 24.5 ml, MAASTRO 36.2 ml) and median length of follow-up (p = 0.010/UHZ 63 mo, MAASTRO 44 mo) differed significantly. Grade IV toxicity was observed in 3 (4.2%) patients.
Conclusions: SCRT is a viable and successful therapy. Moreover, it is a safe and reliable non-invasive treatment for tumours that cannot be resected due to high risks involved.

8723 POSTER

Spot Scanning Proton Beam Therapy for Intracranial Meningioma − Long Term Results From the Paul Scherrer Institute

D.C. Weber[1], R. Schneider[2], G. Goitein[2], C. Ares[2], J. Geismar[2], A. Bolsi[2], E.B. Hug[2]. [1]*University Hospital, Radio-Oncologie, Geneva 14, Switzerland;* [2]*Paul Scherrer Institut, Proton Therapy Center, Viligen, Switzerland*

Background: To assess the long term clinical results of spot scanning based proton therapy (PT) in the treatment of intracranial meningiomas.
Material and Methods: Thirty nine patients with meningioma (histologically proven 34/39) were treated with PT between July 1997 and January 2010. Thirty two (82.1%) patients were treated as primary treatment (exclusive PT, *n* = 8; postoperative PT, *n* = 24). Mean age was 48.3±17.9 years and 32 (82.1%) patients had skull base lesions. For patients undergoing surgery, 24 and 10 patients had a diagnosis of WHO grade I and II/III meningioma, respectively. The female to male ration was 3.3. The median administered dose was 56.0 GyE (range, 52.2–66.6) at 1.8−2.0 GyE per fraction. Gross tumour volume (GTV) ranged from 0.76 to 546.5 cm^3 (median, 21.5). Late toxicity was assessed according to CTCAE version 3.0. Mean follow-up time was 62.0 months and all patients were followed for >6 months.
Results: Six patients presented with tumour recurrence and 6 patients died during follow-up, of which 4 of tumour progression. Five-year actuarial local control and overall survival rates were 84.8% and 81.8%, respectively, for the entire cohort and 100% for benign histology. Cumulative 5-year grade ⩾3 late toxicity-free survival was 84.5%. On univariate analysis, LC was negatively influenced by WHO grade ($p = 0.001$), GTV ($p = 0.013$) and male gender ($p = 0.058$).
Conclusions: SSPT is a safe and effective treatment for patients with untreated, recurrent or incompletely resected intracranial meningiomas. WHO grade and tumour volume was an adverse prognostic factor for local control.