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POSTER

Fractionated Stereotactic Radiotherapy (FSRT) for Craniopharyngiomas – Clinical and Radiological Control

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Background: Management of craniopharyngioma remains a challenge because of its relationship with surrounding eloquent structures. Surgical resection is the first-line treatment for craniopharyngioma. However, total removal is difficult and often associated severe morbidity. It has long been established that radiation therapy is effective against craniopharyngiomas. Adverse effects should be minimized as patients are usually young and their life expectancy long. The purpose of this study is to describe results and toxicity of fractionated stereotactic radiotherapy (FSRT) in 14 patients (13 adults) with craniopharyngioma.

Material and Methods: 14 patients with a median age of 40 years (range 15–60 years) were treated by FSRT from January 2001 through March 2011. Surgical resection was done prior to FSRT in all the patients, twice in 6 patients and three times in 2 of them. At the time of FSRT, complete hypopituitarism was present in 8 patients, 9 had diabetes insipidus and 3 had hypothalamic disorders, 4 had neurologic symptoms and 12 had impaired vision, including blindness in one of them. FSRT was delivered through a LINAC with BrainLAB[®] system using a micro-multileaf collimator. Noncoplanar fixed five- or seven-beam arrangement, with or without intensity modulation, was used. Total dose of 50–53 Gy in 1.8 Gy/day fractions (median 50.7 Gy) was delivered to the target volume.

Results: All patients underwent magnetic resonance imaging (MRI) and visual and neuroendocrine assessment at regular intervals from three to six months after radiotherapy. Tumour shrinkage was noticed in eleven patients at a median of 8 months (range 5–22 months). Tumor remained stable. At a median follow-up of 34 months (range 5–105 months) tumour control was 100%. After radiotherapy one patient experienced visual improvement, neurologic symptoms improved in three patients and pituitary function improved in another patient. No serious complications due to FSRT were found. One patient developed visual worsening immediately after radiotherapy secondary to cystic enlargement.

Conclusion: FSRT as a high-precision technique of localized irradiation achieves good tumour control with low morbidity. Limited surgery followed by radiotherapy is a safe and effective option for patients with craniopharyngioma and may reduce the morbidity of radical surgery. Nevertheless, longer follow-up is required to assess long-term efficacy and toxicity, particularly in terms of potential reduction in treatment related late toxicity.

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POSTER

Salvage Robotic Stereotactic Radiosurgery in Patients With Recurrent Medulloblastoma

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Background: To assess the efficacy of salvage robotic stereotactic radiosurgery (SRS) in patients with recurrent medulloblastoma.

Material and Methods: We treated 9 patients with recurrent medulloblastoma using SRS in our department between June 2007 and September 2010. Four patients were male, and 5 were female. Median age was 30 years (range= 8–45). All patients were treated with surgery and craniospinal radiotherapy as primary treatment. Two patients received 50.4 Gy and 7 received 54 Gy to the primary site. SRS was delivered with CyberKnife (Accuray Inc., Sunnyvale, CA). The median interval between the primary treatment and RSR was 22 months (range, 10–122 months) Median tumour volume was 30 cc (1.5–113 cc). Total dose of 21–30 Gy (median 30 Gy) was delivered in median 5 fractions (3–5 fractions). The gross tumour volume was described as the clinical target volume. Median homogeneity and conformality indices were 1.29 (1.18–1.43) and 1.92 (1.31–2.65) respectively. Biologic equivalent dose of 2 Gy (BED₂) was calculated for the total doses, and applied for all patients to evaluate dose-response and dose-toxicity relationship analyses.

Results: Median follow-up was 15 months (range, 6–28 months). Lesions were stable in 3 patients (33.3%), and complete response was observed in 1 patient (11.1%). Partial response was seen in three patients (33.3%). Progression was observed in two patients (22.2%). At the time of reporting one patient was alive without evidence of disease, and four with evidence of disease. Four patients died. Three of deaths were due to tumour progression, and one was due to chemotherapy toxicity. The symptoms either regressed or were stable in 67% of patients. Median BED₂ was 213 Gy (122.5–222.5 Gy). Local control without increasing the toxicity was achieved in patients treated with a total dose of BED₂ ≥210 Gy.

Conclusions: SRS seems to be a promising treatment modality for patients with recurrent medulloblastoma. We observed that SRS is more effective in terms of local control when BED₂ doses over 210 Gy were applied.

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POSTER

Relationship Between Relative Dose at the Periphery and Local Control in Brain Metastases Treated With Radiosurgery

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Background: For brain metastases treated with radiosurgery, the relationship between local control (LC) and relative dose coverage at the periphery is not well known. This study evaluates the relationship between local control and relative dose delivered to the planning target volume (PTV).

Material and Methods: We retrospectively analysed data from patients treated by LINAC radiosurgery with 1 to 4 brain metastases with a diameter of 4 cm or less. A PTV margin of 1 mm was generated. Volume receiving 100% of the prescribed dose (V100) for this PTV was plotted and classified in <90% and ≥90% sub-groups. The primary endpoint was local progression free survival (PFS). Follow up MRIs done at 3-month intervals were reviewed. Local progression was defined as the first progression in the size of the lesions. Overall survival (OS) was evaluated as a secondary endpoint. OS and PFS were determined using the Kaplan–Meier method. The log-rank analysis was used for comparison.

Results: We identified 103 lesions in 56 patients treated in one Canadian center between June 2008 and August 2010. Median follow-up was 15.6 months. For LC, we reviewed MRIs for 80 lesions having radiological follow-up. Lesions were predominantly lung cancer metastases (75%). Prescription doses were as suggested in the RTOG 9005 protocol. Median time to local brain metastases progression was 8.9 months. PFS at 3, 6, 9 and 12 months were respectively 91.3%, 72.7%, 45.8% and 37.0%. PFS at 3, 6 and 9 months for V100≥90% were respectively 89.3%, 63.7%, 25.5% compared to 93.5%, 84.5% and 74.0% for V100<90% (p=0.003). 88.2% of lesions having a PTV V100<90% were treated with doses of 21 or 24 Gy while 56.5% of lesions having a V100≥90% were treated with doses of 15 or 18 Gy. Prescription dose was significantly (p=0.008) associated with PFS in favor of the higher doses. Sub-group analysis regarding PTV coverage was done for each prescription dose trying to isolate the metastasis size effect on PFS. No statistically significant difference in PFS was seen in the 15, 18 and 24 Gy sub-groups for PTV V100≥90% compared to V100<90%. In the 21 Gy sub-group, PTV V100≥90% was associated with poorer PFS (p=0.031) but there were only two LC failure events in this sub-category. Median survival was 15.7 months. A significant factor associated with OS was control of primary disease with a median survival of 23.3 vs. 12.5 months in the absence of control (p=0.003).

Conclusions: Consideration of the relative dose delivered at a 1 mm PTV in brain metastases treated with radiosurgery does not seem to be correlated with a better LC. However, in our cohort, lesions with lower PTV coverage were those with higher prescription doses, thus of smaller size. Those seemed to have a better LC compared with lesions with higher PTV coverage. This suggests an outweighing effect of the prescription dose and the lesion size over the PTV coverage. Sub-group analysis for each prescription dose failed to show a LC advantage for better PTV coverage.

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POSTER

Robotic Stereotactic Radiation Therapy Alone in the Management of Oligometastases of the Brain – Analysis of 56 Patients Treated at the Alexis Vautrin Cancer Center

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Background: Randomized trials suggest the combination of radiosurgery with whole brain irradiation as a standard to treat oligometastases of the brain. Radiosurgery is sometimes used alone in selected cases, but frequent follow up is highly recommended to detect recurrences for salvage therapy.

Purpose: To report the analysis of patients presenting with oligometastases of the brain and treated with robotic stereotactic radiotherapy alone at the Alexis Vautrin Cancer Center.

Materials and Methods: 56 patients with 65 brain metastases received robotic stereotactic radiotherapy between December 2007 and September 2010. Forty seven patients presented with a single brain metastases and 9 with 2 metastases. Twenty three patients (41.07%) had adenocarcinoma of the lung, 10 patients (17.85%) had other Non Small Cell Lung Cancer, 7 patients (12.5%) had infiltrating ductal carcinoma of the breast, and 16 (28.57%) had miscellaneous histologic diagnoses. All patients had a Karnofsky performance status index of 70 or more at diagnosis of the

brain metastases. The dose delivered was 23.1 Gy in 3 fractions over 3 to 8 days, calculated on the 70% isodose line.

Results: Median follow up was 9.7 months (2.2 to 36.0 months). Twenty four patients (42.8%) needed salvage treatment of whom 5 (20.8%) had another stereotactic radiotherapy and 19 (79.2%) had other modalities of salvage therapy, mainly whole brain irradiation. The survival rates at 6, 12 and 24 months were 88.8%, 78.1% and 69.1% respectively.

Conclusion: Survival results are encouraging. Rigorous selection of patients is needed when using robotic stereotactic radiotherapy alone for the treatment of oligometastases of the brain. Close follow up allows salvage therapy in such cases.

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POSTER

Role of Surgery and Postoperative Radiotherapy for Patients RPA I or II With 1 or 2 Brain Metastases

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Purpose: To evaluate the role of surgery and postoperative radiotherapy in the management of brain metastases (BM). A retrospective analysis for overall survival of a series of 282 patients with recursive partitioning analysis (RPA) I or II with 1 to 2 resectable BM treated with different schedules in single institution.

Methods: Patients with median age 61.5 at diagnosis were treated either with surgical resection followed by whole brain radiotherapy (WBRT) or with WBRT alone in 94 (33.3%) and 188 cases (66.7%) respectively. Dose of irradiation varied from 30 to 40 Gy in fractions of 2 to 3 Gy. Eighty-five patients who underwent surgery and 125 who benefited from WBRT alone received a WBRT boost to the metastatic site (from 9 to 17.5 Gy in 2 to 3 Gy per fraction). Diagnosis has been established by contrast CT scan or MRI or both. BM were located in the cerebral hemispheres (76.6%), in the cerebellum (16.3%) or in these two sites (7.1%). Primary tumours were lung (61.4%), breast (11.4%), melanoma (6%), gastrointestinal (7.4%), kidney (4.6%) and other sites (9.2%). In the surgical group, patients were RPA I and II in 43 and 51 cases, respectively and had 1 or 2 BM in 86 and 8 cases, respectively. In the group of definitive WBRT, patients were RPA I and II in 19 and 169 cases, respectively and had 1 or 2 BM in 115 and 73 cases, respectively. Survival probabilities were calculated using the Kaplan-Meier method.

Results: Median overall survival was higher in RPA I group compared to RPA II group: 34.5 months (n=62) and 8.6 months (n=220), respectively (p<0.0001). There was a significant improvement of overall survival in the surgical group compared to definitive WBRT group: 20.9 months vs 7.8 months (p<0.0001), also 6-month and 1-year overall survival were significantly better: 87.5% vs 63.4% and 68.2% vs 32.8%, respectively. Patients who underwent a WBRT boost had an improved outcome but the difference was not statistically significant: 22 months vs 19.1 months for the surgical group and 8.7 months vs 6.6 months for the second group. In multivariate analysis, presence of extracranial metastases and control of primary tumour were significant prognostic factors for the two groups (p=0.002 and p=0.008 respectively for the surgical group; p=0.04 and p=0.01 respectively for the definitive WBRT group). In the definitive WBRT group type of primary tumour was also significant (p=0.0008).

Conclusion: Surgical resection followed by WBRT lead to a better outcome compared to WBRT alone for patients with 1 or 2 BM, and for RPA I or II. An additional WBRT boost did not improve significantly the overall survival, whatever the treatment schedule.

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POSTER

Post-Operative Irradiation Volume and Survival of Patients With High-Grade Malignant Gliomas

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Background: According to recent recommendations, initial post-operative volume of irradiation (RT) in high-grade malignant gliomas (HGMG) has been shrunken from whole brain to tumour bed with margins. Probable sequences of that change are still unclear. We conducted retrospective trial to compare outcomes of the treatment focusing on mentioned radiation treatment characteristic.

Materials and Methods: Outcomes of HGMG patients treated with consecutive surgery, RT/chemoRT and chemotherapy were compared with reference to the volume of initial RT: whole (30 Gy/15 fr to whole brain than

local irradiation with margin to edema to total 54–64/27–32 fr Gy, WBI) versus local (LBI). Proportions were assessed using chi-square. Overall survival (OS) was chosen as endpoint. Kaplan-Meier plots with log-rank test were used for comparisons. Univariate and multivariate analyses were applied with proportional hazards Cox regression model.

Results: Total 427 patients with G3–4 gliomas were selected. Three hundred forty four (81%) were irradiated locally only, while 83 – with initial whole brain RT. Distribution according to basic initial characteristics between the two groups was similar except age >60 yrs (40% vs 25%, p=0.050) and Karnovsky performance score less than 70% (53% vs 80%, p=0.035) for LBI and WBI respectively. With median follow-up 2.6 (SD, 1.8) yrs of analysis 56 (16%) and 39 (47%) pts after LBI and WBI died. Median OS for LBI and WBI was 16 and 40 months respectively, log rank, p<0.0001. Volume of irradiation significantly influenced on OS both in univariate, HR=2.1, p=0.0005 and in multivariate analysis, HR=1.6, p=0.021.

Conclusion: Avoiding whole brain irradiation in HGMG leads to significant gain of survival.

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POSTER

Stereotactic Radiosurgery and Radiotherapy in Benign Intracranial Meningioma

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Background: To investigate the role of stereotactic radio surgery (SRS) and hypofractionated stereotactic radiotherapy (SRT) in treatment of benign intracranial meningioma.

Materials and Methods: Between 2003–2010, 32 patients with a median age of 44 years (21–67 years) were treated with SRS (n=19), and hypo fractionated SRT (n=13) for intracranial meningioma. Of the 32 patients 14 underwent SRS or SRT as their primary treatment and 18 patients underwent post operative SRS or SRT (PORT). Progression free survival and overall survival, toxicity and symptomatology were evaluated.

Results: The median follow up was 39 months (6–72 months) and 5 year overall survival and Progression free survival were 90%±5 and 94%±4 after SRT/SRS respectively. The symptoms were improved or stable in 97% of patients. Acute toxicity was mild and seen in 41% of patients. Clinically significant late morbidity or new cranial nerve palsies did not occur.

Conclusion: Stereotactic radio surgery (SRS) and hypo fractionated stereotactic radiotherapy (SRT) are effective and safe treatment modality for local control of meningioma with low risk of significant late toxicity. In case of large tumour size and adjacent critical structures hypo fractionated SRT is highly recommended.

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POSTER

Cerebral Arteriovenous Malformations Treatment With Radiosurgery – Results From the CHUM

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Background: Therapeutic modalities for arteriovenous malformations (AVM) are embolization, surgery and radiosurgery, and they are usually used in association. Factors influencing the choice of therapy are mainly localization and size of the AVM, with the ones located in eloquent locations and of large size representing a significant surgical risk. Radiosurgery is recognized to offer a high obliteration rate for small and medium size lesions, with mild morbidity. We expose the characteristics of patients treated at the Notre-Dame hospital with radiosurgery, with special attention to obliteration rates and radionecrosis.

Materials and Methods: A systematic review of all cerebral AVM patients treated in the Radiation Oncology Department at the Centre Hospitalier de l'Université de Montréal, Notre-Dame hospital, from 1998 to 2008 inclusively was performed. A total of 43 patients treated with a single dose varying between 21 and 25 Gy were included. Medical files were analysed in order to assess the following informations: the characteristics of patients and AVM, the treatments received prior to radiosurgery, the date and the dose of treatment, the date of obliteration (absence of flow within the lesion demonstrated by digital angiography) and toxicities, when applicable. Revision of angiographies was performed to complete the data. Also, telephone interviews were done in order to evaluate the degree of limitation in daily life activities of patients.

Results: Most patients are men, with a mean age of 37 years old (12–65). Over 75% presented with haemorrhage, and two patients had a fortuitous diagnosis. AVM of 3 cm or more in diameter was found in 20.9% of patients.