EARLY TRENDS IN GAMMA KNIFE TREATMENT OF BRAIN METASTASES AT QSRC/UCLH

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Background: Brain metastases (BM) occur in 20-40% of cancer patients and they represent a significant cause of morbidity and mortality. Gamma Knife Radiosurgery (GKR) is a well-established treatment modality for brain metastases. Large multicentre studies have reported a consistently high local tumour control rate of around 90% following GKR.

Aim: This retrospective study assessed the overall survival, local tumour control rate and adverse radiation effects (ARE) in our patients treated for brain metastases.

Patients and method: Between October 2012 and December 2016, 108 GK procedures for BMs were performed in 95 patients. Nine patients underwent more than one GK procedure. Retrospective clinical and radiological data were collected from the hospital database, PACS and from the planning station. A total number of 391 metastases were treated in this population, with a mean number of 4 BMs/patient (range 1 to 18). The main three primary origins of BMs were lung, breast carcinoma and malignant melanoma.

Results: Average target volume of BMs at treatment was 1 cc. More than half of the lesions were micrometastases (volume <140mm^3) and 8.7% of them had a volume superior to 4cc.

The marginal (prescription) dose was between 18 and 25 Gy. The dose was adjusted depending mainly on the target volume, but also on the location, origin of the BMs and previous WBRT. The average treatment duration was 79 minutes.

The median overall survival from Kaplan-Meier analysis was 14.7 months. Patient with WHO Performance Score (PS) of 0 and 1 showed prolonged median survival comparing with those with PS 2 (19.8 and 14.7 vs 5.2months). The control of the extracranial disease was also statistically correlated with prolonged survival ($p<0.001$).

The percentage of the BMs with complete response, reduction or stability at 2, 6 months and on their last MRI were 96.5%, 92% and 93% respectively.

The overall local control rate of the treated lesions was 97%. Only 10 out of 391 lesions were considered to have a treatment failure and required other treatment.

A temporary or long-standing increase in volume considered to be an adverse radiation effect (grade 3-5 ARE) was noted in 6.4% of the treated lesions. These were represented by sub-acute tumour swelling with perilesional oedema, intratumoural haemorrhage or delayed radionecrosis. The risk of severe ARE was statistically correlated with the target volume, previous WBRT and possibly high energy rate. The distinction of ARE from true tumour progression was difficult in many cases and it required serial MRI follow-up.

Discussion and conclusions: Gamma Knife treatment provided an excellent overall local tumour control rate of 97%. The median overall survival of 14.7 months was comparable or superior to most of the similar series of patients. Patients with good WHO PS and controlled extracranial disease showed prolonged survival. The rate of adverse radiation effects was relatively low (6.4%) and in most of the cases they were reversible.