The Leeds Teaching Hospitals NHS Trust

Mask-based, Fractionated Radiosurgery for Brain Metastases using Gamma Knife Icon©

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Introduction

- **Gamma Knife Icon© allows mask-based, fractionated brain radiosurgery (as well as standard, frame-based treatment).**
- **Leeds was one of the first centres in the world to start using it in December 2015.**
- **Between then and December 2017, 58 patients with brain metastases were treated in this way (median age 67, range 27-89).**

Fractionation Method

- Standardised fractionation was used
- (either 27Gy in 3# in **64%**, or 30Gy in 5# in **33%**, largely depending on volume).
- Two patients **(3%)** had single fractions using a mask to avoid having a frame.
- Unlike some centres that "stage" fractions with 1-2 week gaps, treatment was given on consecutive working days using a single treatment plan (planning MRI within 72 hours of first fraction).

Potential advantages of fractionation:

- Ability to treat larger targets (classically >3cm)
- Ability to re-treat areas after prior SRS
- Sparing adjacent eloquent structures (eg optics / brainstem)
- Flexibility - if diagnostic scan old and borderline size of target
- (Patient choice, technical challenge to frame fitting)

Commonest primaries:

- Lung **(41%)**
- Breast **(24%)**
- Gastrointestinal **(22%)**
- Melanoma **(3%)**

Main indication for mask-based treatment was:

- Size (in **74%**)
  - median 16cm3
  - IQR 12.3 - 19.7cm3
  - maximum 30.4cm3 in this group
- Re-treatment (**14%**)
- Eloquent location such as brainstem (**9%**)
- Patient choice (**3%**).

Case Selection

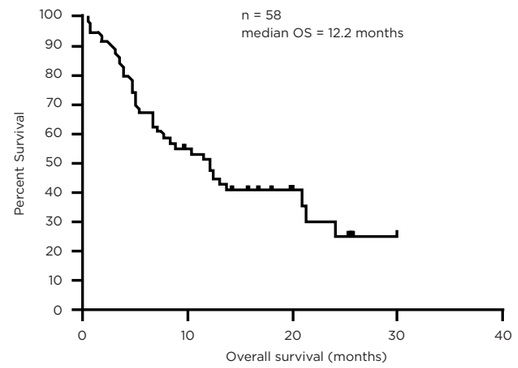
- Median KPS - 90 (range 70-100).
- Solitary metastasis in **53%** of cases, multiple (range 2-5) in the remainder.

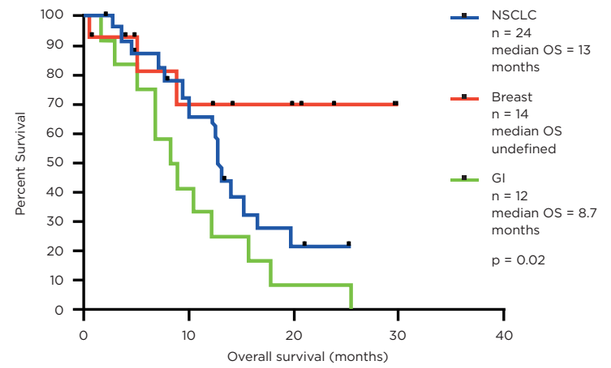
Detailed follow up for 43 patients

- **94%** of those on steroids reduced them after treatment. **85%** stopped them completely.
- None had a permanent neurological deficit caused by treatment.
- **9%** developed leptomeningeal disease during follow up.
- **26%** had local failure at a median of 300 days.
- **40%** had imaging changes (at a median of 170 days) felt to represent treatment effects but this was only symptomatic in 4 (**9%**). Only 2 required admission for these (one of which was re-treatment in an eloquent location).

Survival

- Median overall survival was 12.2 months.
- Survival was not significantly different between:
  - the 3 or 5 fraction groups (p=0.74),
  - largest target volume treated: greater or less than volume of a 3cm diameter sphere (p=0.32)
  - or total treated volumes greater or less than 20cm3 (p=0.51).





Conclusions:

- **Fractionated, mask-based treatment of brain metastases using Gamma Knife ICON© is safe, efficient and effective.**
- **Useful for larger targets, re-treatment and eloquent locations.**
- **Treating on consecutive days (rather than staged) requires only a single scan / treatment plan and completes treatment quickly.**

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