

CONTRIBUTORS

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CASE REPORT

A Distributed and Efficient Method to Treat Multiple Brain Metastases Using Leksell Gamma Knife® Icon™

- 38 year old male
- Patient presented with lung cancer and multiple metastases in the brain
- No significant headaches, nausea or vomiting
- Molecular status was ALK+ve, EGFR and PDL1-ve

CASE OVERVIEW

Number of metastasis:

34

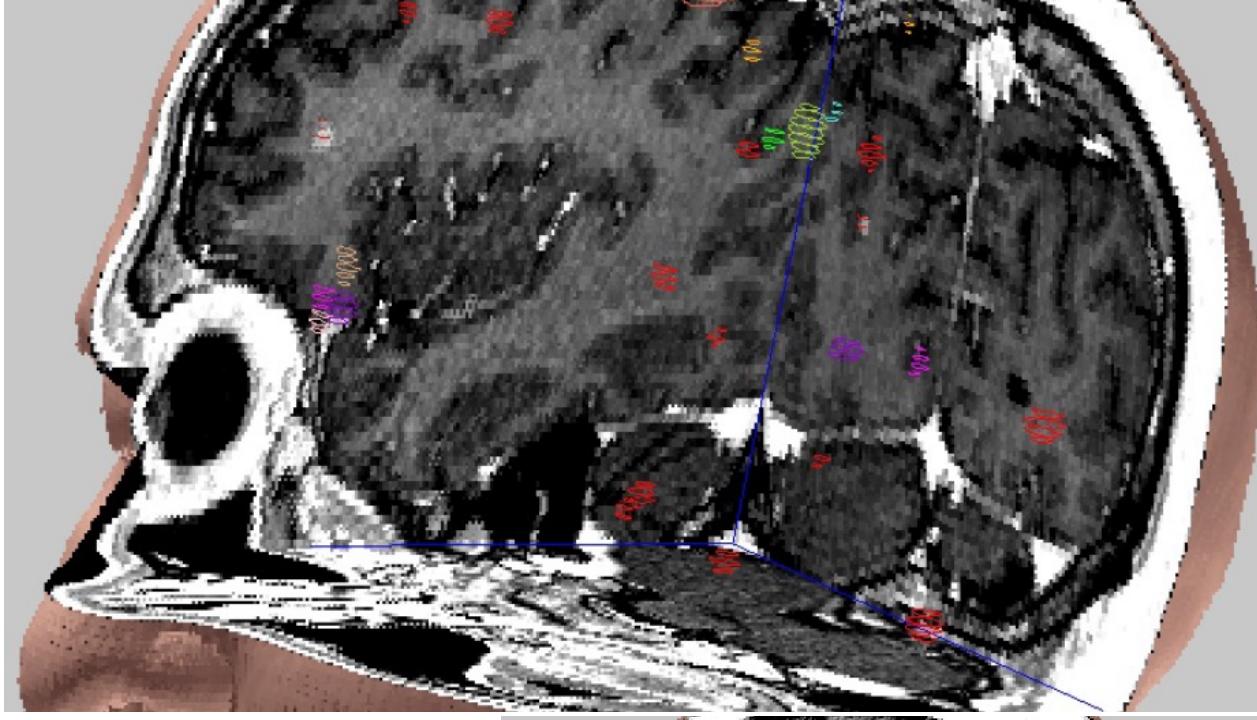
Median (range) GTV volume:

0.026 (0.004 – 2.517) cm³

(note: The range of the targets is 0.004 - 0.265 cm³ if the largest target is excluded.)

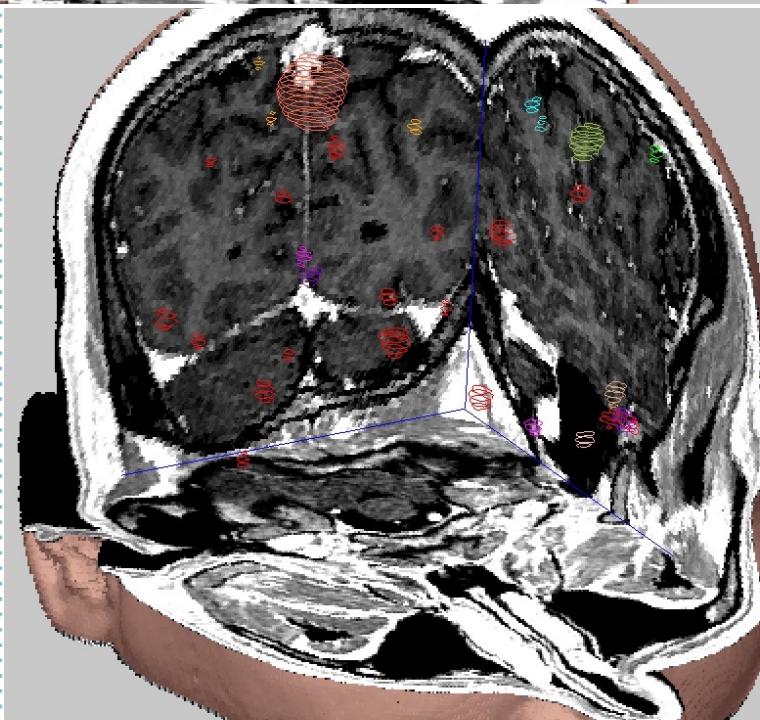
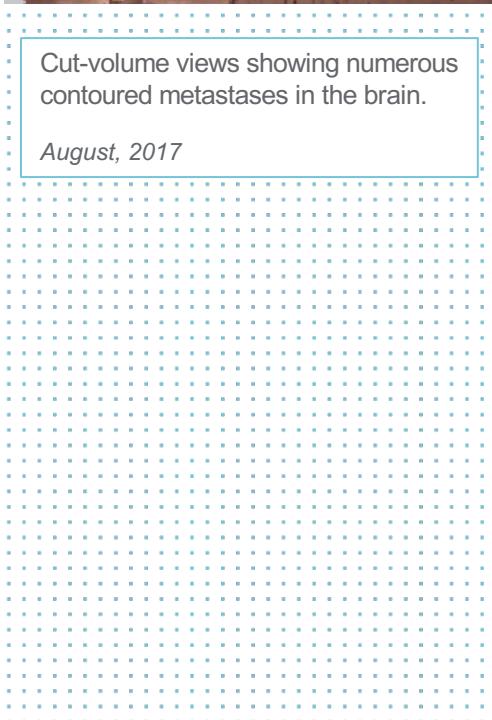
Total GTV volume:

4.0 cm³



Cut-volume views showing numerous contoured metastases in the brain.

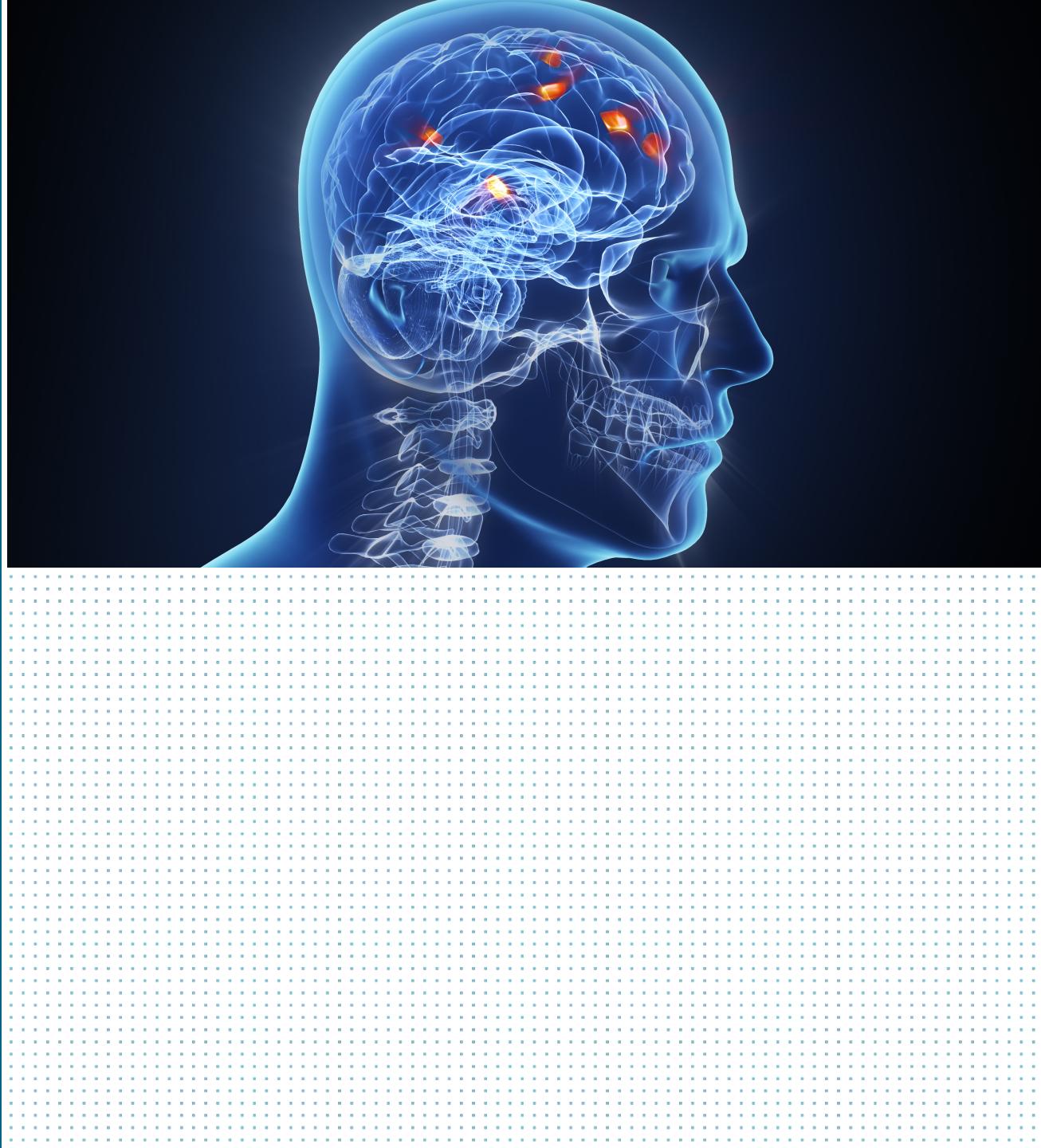
August, 2017



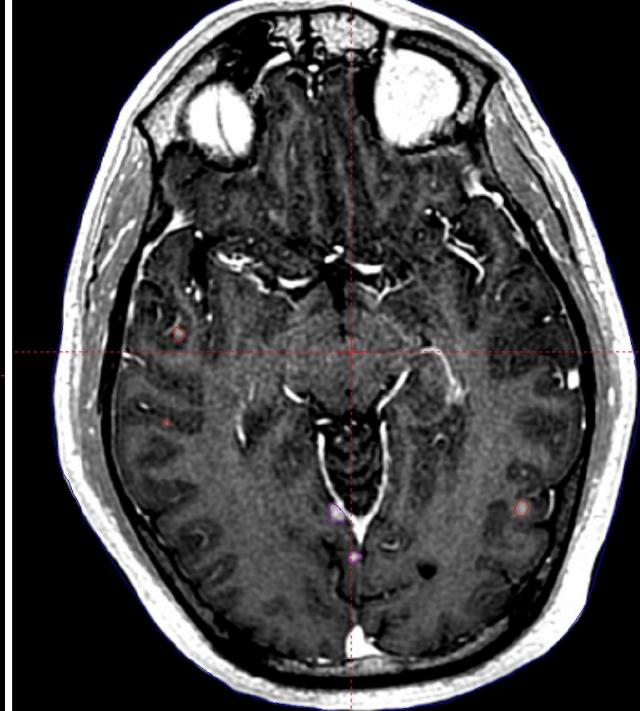
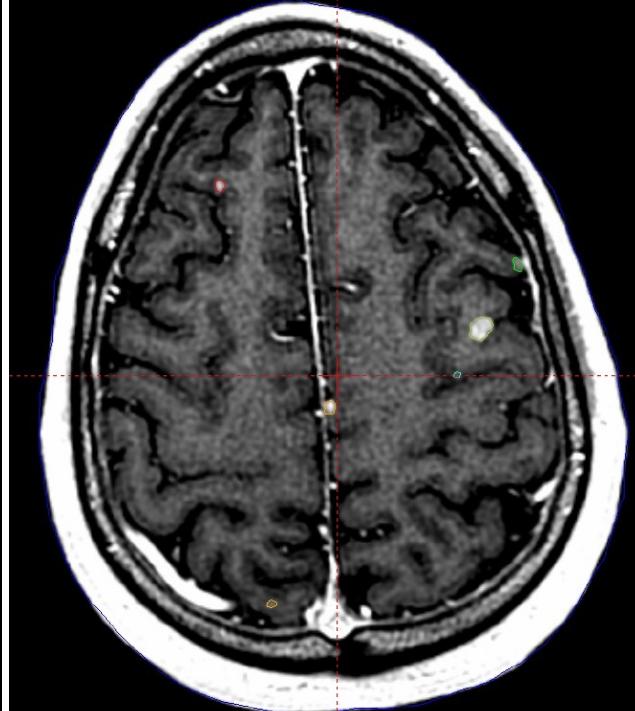
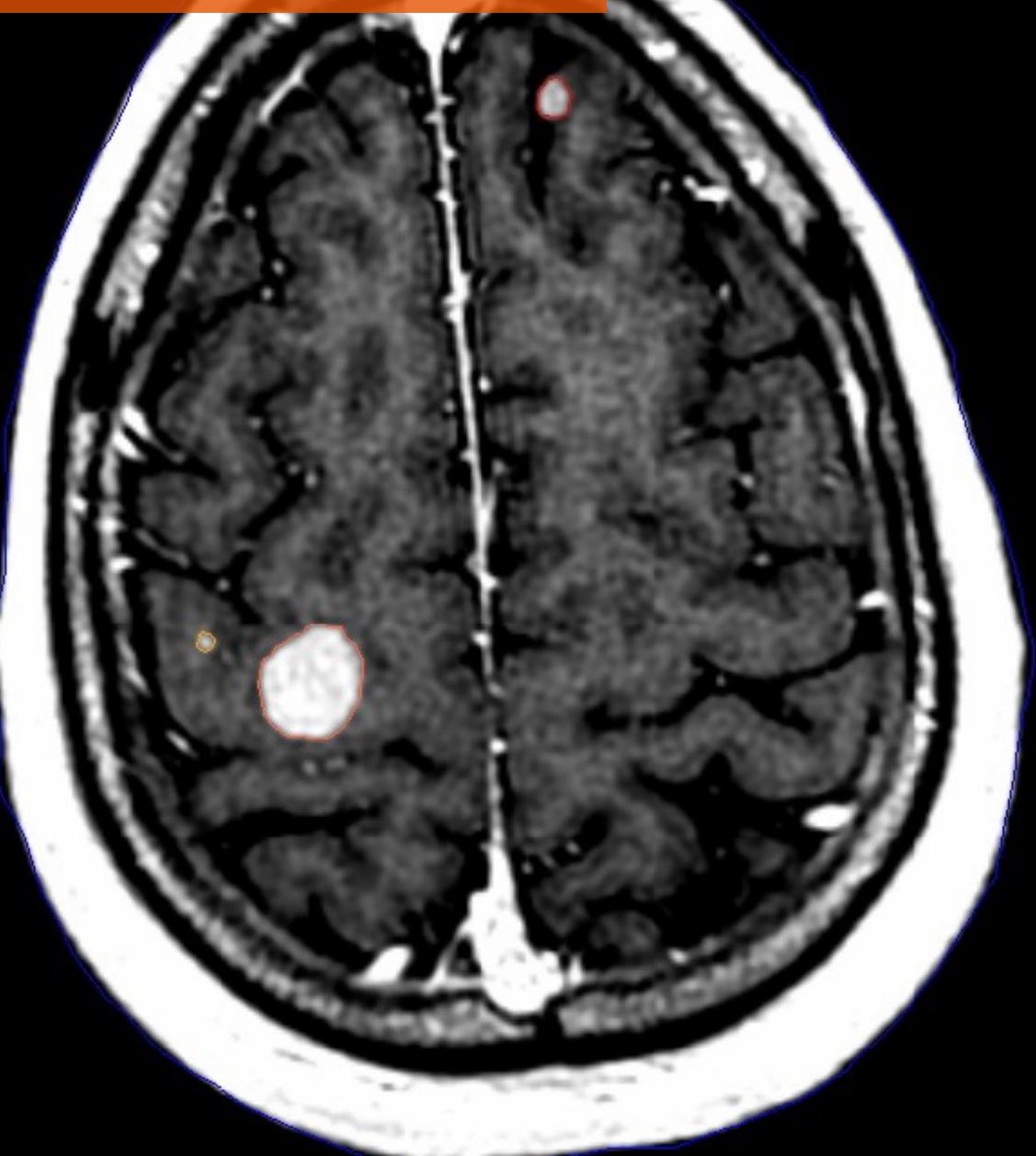
WHY Leksell Gamma Knife Icon?

Given that the patient is young, ALK+ve and newly diagnosed, the team at Sunnybrook wanted to provide definitive local control to the existing lesions and reserve whole brain radiation as a salvage therapy. Especially as the new targeted agents for ALK+ve lung cancer can cross the blood-brain-barrier and potentially control micrometastatic disease.

As the majority of the tumors are sub-centimeter, Leksell Gamma Knife was thought to be the ideal technology as the normal brain tissue will receive the lowest integral dose as compared to MLC based technology. Another consideration was the ability to maximize dose fall-off as when targets are close together the aim is to limit the bridging doses.



Different axial MR slices showing multiple metastases contoured in the brain

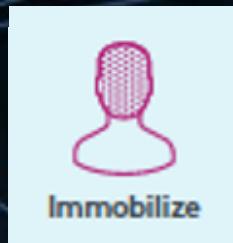


TREATMENT PROTOCOL

- All targets were treated in 6 sessions over 8 days
- 3 to 7 targets were treated each day
- Rx = 18Gy - 32/34 targets (to 43% - 80% isodose line)
- Rx = 16Gy – 2/34 targets (to 75% and 80% isodose lines)
- Most of the targets were treated with a single shot
- Total # of shots: 45
- Segmentation tool allowed for fast accurate target delineation (minutes to contour them all)

WORKFLOW

Targets were treated in six sessions over eight days



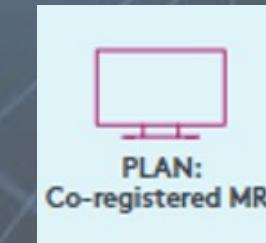
1. Mask molding



2. Initial CBCT



3. Brain MRI



4. Dose planning

- Repeated for multiple days to treat all the targets.
- Each day, new plan was generated (using the 'replan' function)



5. Treatment delivery

- CBCT to verify actual skull position
- Automatic co-registration to determine daily shift in translation and rotation
- Automatic adaption by TPS to daily position; recalculation of dose distribution

Steps 1 through 3 were carried out prior to the first radiosurgery session

Steps 4 and 5 were repeated during each of the six sessions

RESULTS

- Patient had an excellent response to treatment, with the majority of tumors either regressing or completely resolving at 3 months with no new metastases. The response persisted at 9 months.
- He remains neurocognitively intact and continued to work.
- The patient was not fatigued and did not require steroids.
- At the last follow up his disease was under control with no progression intra-cranially nor extra-cranially
- He remains on current Osimertinib systemic therapy.



"Icon allowed for convenient treatment of multiple metastases with essentially no complications. The intent is rational in terms of controlling gross tumor and allowing novel agents to control micrometastatic disease. This is a strategy to avoid WBRT and reserve it as one of many salvage therapies that can be applied if needed. Given that we were treating 34 metastases, rather than occupy the machine for several hours and have the patient in a head frame, 'distributed' SRS was applied. We treated several targets per day allowing for up to 60 minutes in the mask. This approach also allows for the total dose within the normal tissue to be fractionated and it is thought this would be radiobiologically better for the normal tissue."

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Clinical images supplied courtesy of Sunnybrook Health Sciences Centre

