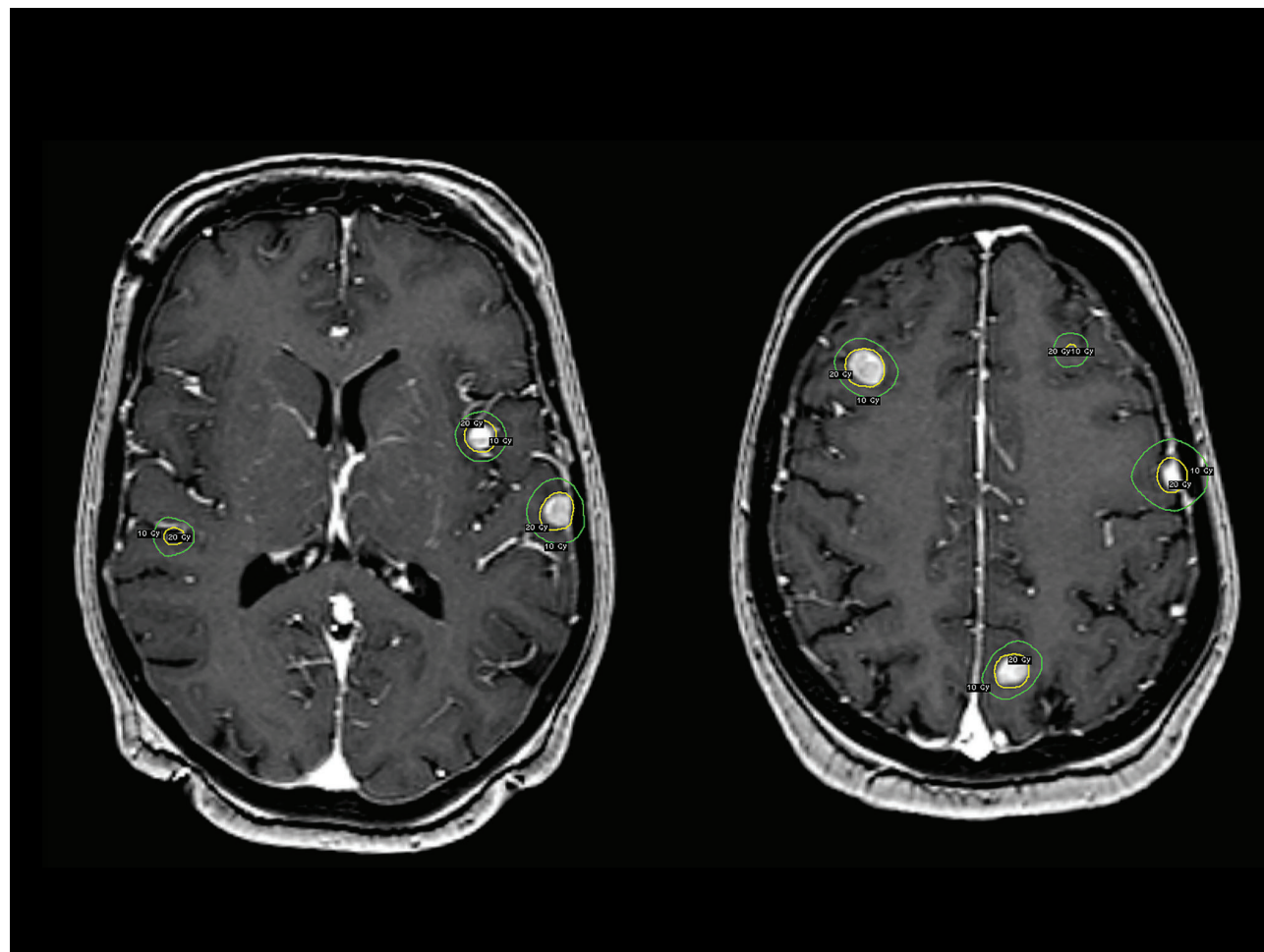




# Leksell Gamma Knife<sup>®</sup> Radiosurgery

Brain  
Metastases

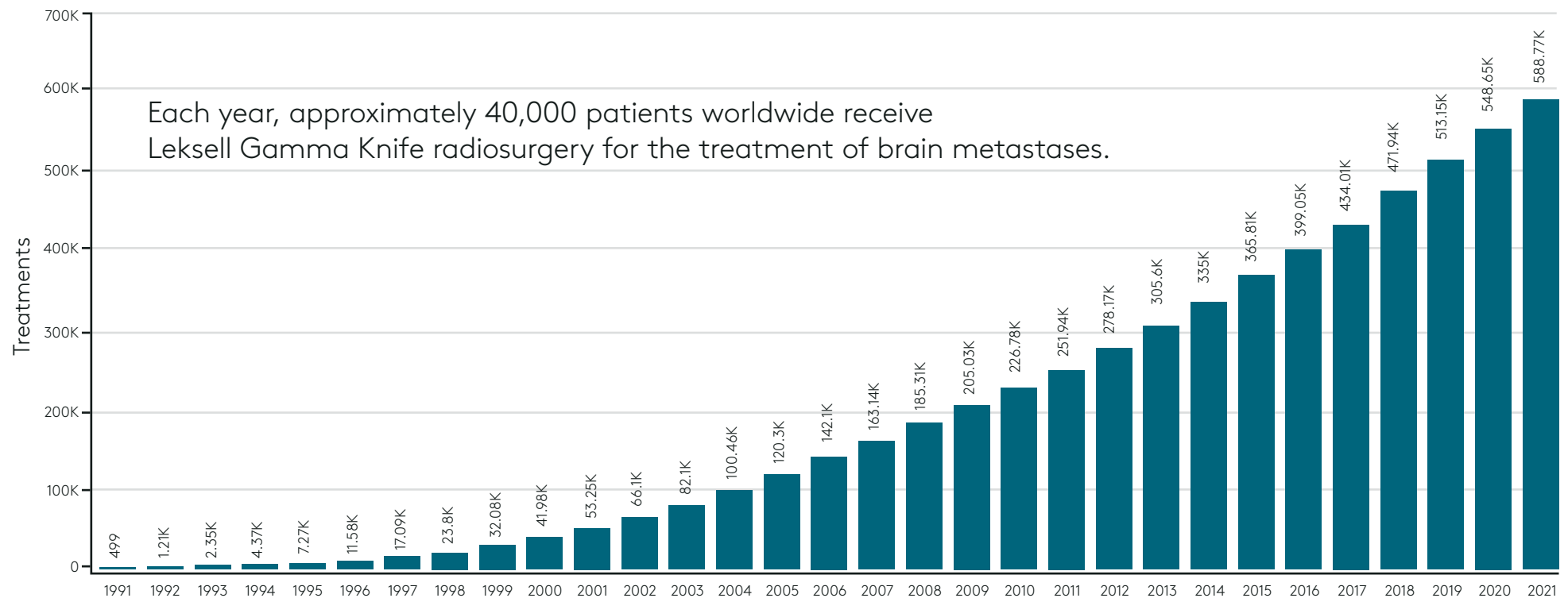


## A more targeted approach

Advances in CT and MRI have made visualization and localization of even the smallest tumors possible, allowing the use of more targeted treatment strategies. Current treatment modalities for brain metastases include surgical removal, stereotactic radiosurgery (SRS), whole brain radiotherapy (WBRT), and targeted pharmacological treatments. Decisions about treatment are

made against the background of advanced disease and take into account the patient history, current status and patient preference. With patients living longer from primary disease and having secondary disease managed in the long term, maintaining quality of life is extremely important.

## Brain Metastases—Accumulated number of patients treated worldwide since 1968\*



\*Leksell Gamma Knife Society treatment statistics 2021. 1991 reflects cumulative numbers since 1968.

## Preserving quality of life

The treatment of brain metastases involves several considerations. For example, different primary tumors have varying degrees of aggression and respond differently to radiation. In addition, brain metastases may vary in size, number, location, and distribution, and the degree of extracranial disease control has a marked influence on patient survival.

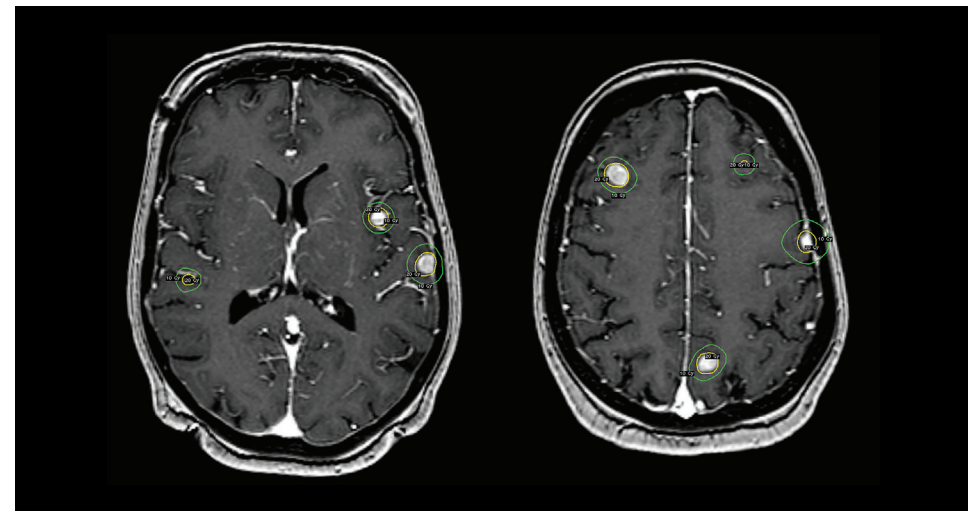
Although WBRT was once standard of care for multiple brain metastases, it has declined in popularity due to concerns about neurocognitive deficits.<sup>1,2</sup> Gamma Knife radiosurgery (GKRS) is a more targeted approach for the treatment of multiple brain metastases. It uses 192 narrow radiation beams to concentrate dose precisely to each target with unbeatable accuracy, while sparing healthy brain and avoiding critical structures better than any other brain radiation therapy technique.<sup>3-5</sup> This makes it the ideal treatment choice for brain metastases—even when they are located in difficult-to-reach areas of the brain or in close proximity to eloquent areas. It can be delivered in single or multiple sessions, using adaptive, and staged approaches to tackle even the largest tumors.

Since GKRS is used to treat visible secondary tumors from primary disease, further treatments for new tumors can be anticipated and managed as part of ongoing treatment and care. The number of brain metastases that can be treated using GKRS has expanded with increasing experience.<sup>2,6,7</sup> It is now widely accepted that the limiting factor for GKRS is not the number of brain metastases but the total volume of the tumors.<sup>3,8-10</sup>

The total volume of brain metastases treated is limited because the larger the volume, the greater the risk of irradiating surrounding healthy brain tissues. Control of brain metastases needs a high dose—between 15 to 24 Gy, depending on the volume of the tumor<sup>11-13</sup>—and, as a safety measure, the volume of brain receiving 12 Gy or more is limited.<sup>14-17</sup> Within these parameters, GKRS treatment of brain metastases has desirable results. Local control rates are excellent, ranging from 80% to over 90%.<sup>8,18-20</sup> In addition, bearing

in mind the poor prognosis of untreated disease, life expectancy following GKRS varies from several months to more than one year.<sup>8,18,21</sup> Moreover, recent studies confirm that survival is most often determined by the systemic, extracranial disease in such patients, not by the brain metastases.<sup>22,23</sup>

Since it is not limited by the number of targets, Gamma Knife radiosurgery offers an attractive alternative to whole brain radiation therapy (WBRT) for the treatment of multiple brain metastases.<sup>24</sup> It also provides better sparing of normal brain tissue for single or multiple targets compared to other stereotactic radiosurgery (SRS) techniques.<sup>4</sup> By protecting healthy brain and providing excellent tumor control rates,<sup>25,26</sup> even for metastases from radioresistant primaries<sup>27</sup>, Gamma Knife radiosurgery helps to preserve neurocognitive function and to safeguard or improve quality of life for brain metastases patients<sup>28-30</sup>. The protection of healthy tissue reduces treatment-related toxicities<sup>31-36</sup>, minimizes long term side effects<sup>4,37</sup>, and allows patients to receive repeat stereotactic radiosurgery<sup>4</sup>, if required. Gentle and non-invasive, it allows long term management of brain metastases without interruption to ongoing systemic therapies.



**Figure 1.** Gamma Knife radiosurgery is a more targeted approach for the treatment of multiple brain metastases

## Minimizing delays

The nature of brain metastases means that referral MRIs must be recent and post treatment MRIs must be frequent. It is known that 75% of brain metastases can increase in size from referral to the day of treatment.<sup>38,39</sup> In the past there were few recommendations on follow-up imaging frequency but, more recently, MRI every three months has been recommended.<sup>19,40-44</sup> These frequent follow-ups permit more accurate assessment of tumor response.

Everything required for single-session GKRS—from imaging and treatment planning to treatment delivery—can be completed on the same day, causing as little disruption and stress to the patient as possible. Such timely access to same-day treatment minimizes delays in treating fast growing brain metastases.

## Recent advances

With ever-improving design and features, GKRS has the ability to treat larger and more numerous brain metastases using frame or mask fixation, depending on the patient's condition and preference. It also permits fractionation, staging and adaptive techniques, which have increased the size of treatable brain metastases.

For some cancers, progress has been made in the combination of radiosurgery with immunotherapy for the treatment of brain metastases, with promising results.<sup>45</sup> There has also been interest in the adoption of radiosurgery prior to surgical removal of brain metastases to minimize seeding and reduce leptomeningeal spread.<sup>46</sup>

## Conclusion

GKRS treats the vast majority of brain metastases without the trauma of open surgery and without the risks to cognitive function associated with WBRT. It preserves quality of life and extends the life expectancy for patients from a few weeks to a few months or even a year or more. Time away from home is minimal at a time when every day is crucial, and new targeted therapies can be combined with GKRS to produce even better results.

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