

The evolving role of stereotactic body radiotherapy in the management of liver metastasis

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The liver is a common metastatic site for colorectal, lung, and breast cancers. In addition to palliative chemotherapy, there have been advances in therapeutic options for liver-directed therapies, which can prolong patient survival and may be curative. Since the 1960s, hepatic metastasectomy has provided a glimmer of hope to patients with cancer.¹ A study in the 1990s revealed a 5-year survival rate of 37% in colorectal patients who underwent liver resection for treatment of one to three liver metastases.² Improvements in surgical technique, patient selection, and systemic treatment have allowed liver resection to achieve 5-year survival rates of >50%, compared with approximately 5% for patients who receive palliative chemotherapy alone.³

Currently, resectability is defined as the ability to perform complete (R0) resection with adequate preservation of the future liver remnant. The presence of unresectable extrahepatic disease remains a contraindication to liver surgery. For patients who are not good surgical candidates, attractive options include non-surgical liver-directed therapies such as stereotactic body radiotherapy (SBRT), selective internal radiation therapy, transarterial chemoembolisation, hepatic arterial infusion therapy, and radiofrequency ablation.⁴

Over the years, the role of SBRT in the management of liver metastases has considerably evolved; it is now considered safe and effective therapy. Additionally, SBRT provides excellent local control of liver metastases and carries a comparatively low risk of treatment-related toxicity.⁵

Patient selection for SBRT is important. Desirable patient characteristics include good performance status with limited disease burden and adequate non-irradiated liver reserve (≥ 700 cc). Moreover, there is a need for caution regarding the irradiation of liver metastases adjacent to the luminal gastrointestinal tract, which could result in bowel perforation.⁶ For better outcomes, desirable patient characteristics include limited extrahepatic disease, lesion size ≤ 3 cm, and fewer than three hepatic lesions.⁴ Stereotactic body radiotherapy generally provides favourable local control of hepatic metastases; most authors report achieving

approximately 80% local control at 2 years if higher biologically equivalent doses are delivered.^{5–8}

Stereotactic body radiotherapy is administered using a linear accelerator, which precisely delivers high-dose ionising radiation in the form of megavoltage photons; the treatment is administered in one to five fractions within 14 elapsed days. The dose closely conforms to the target, leading to rapid dose fall-off outside of the target. Usually, SBRT doses are prescribed to the 80% isodose line, which covers at least 95% of the planned target volume.⁸ Nevertheless, irradiation of the liver can result in radiotherapy-induced liver diseases, which may lead to liver failure and even death, particularly in cases of re-irradiation. In terms of radiobiology, the liver obeys the parallel architecture model; thus, the risk of radiotherapy-induced liver disease is generally proportional to the mean dose of radiation delivered to normal liver tissue. This risk can be minimised by ensuring high accuracy in respiratory motion management via four-dimensional computed tomography, in combination with active breathing control, abdominal compression, or respiratory gating. On-boarding imaging must be conducted before SBRT to allow for the immediate correction of patient positioning.⁹

In this issue of the *Hong Kong Medical Journal*, Choi et al¹⁰ conducted a retrospective study of 31 patients with liver metastases treated by SBRT between January 2012 and December 2017. Actuarial in-field local control rates at 1, 2, and 3 years after SBRT were 93%, 55%, and 42%, respectively. The median survival was 32.9 months; the 1-year, 2-year, and 3-year actuarial survival rates were 89.6%, 57.1%, and 46.2%, respectively. The treatment was well-tolerated. The authors concluded that patients receiving post-SBRT chemotherapy had significantly longer overall survival, highlighting the need for multimodal treatment with effective systemic therapy, rather than monotherapy with either method alone. This real-world evidence supports the evolving role of SBRT in the management of liver metastases in Hong Kong. There is increasing clinical interest in the use of SBRT to manage liver metastases; this new direction is accompanied by many challenges and questions. Future prospective studies may shed light

on the most effective SBRT treatment sequence, key factors concerning patient selection, and optimal systemic treatment (in combination with immunotherapy and chemotherapy) for patients with liver metastasis.

Author contributions

The author was solely responsible for drafting of the manuscript, approved the final version for publication, and takes responsibility for its accuracy and integrity.

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