Sri Lanka Journal of Medicine **SLJM**

Case Report

Citation: Hama Y, Tate E, 2023. Concurrent Chemoradiotherapy for Cardiac Metastasis After Oesophageal Carcinoma Resection. Sri Lanka Journal of Medicine, pp 62-64.
DOI: https://doi.org/10.4038/sljm.v32i2.417

Concurrent Chemoradiotherapy for Cardiac Metastasis after Oesophageal Carcinoma Resection

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ABSTRACT

Oesophageal cancer can rarely metastasize to the heart. We present a case report of a 48-year-old male patient who was diagnosed with cardiac oligometastasis six months after resection of the oesophageal cancer. The patient was treated with rotational intensity-modulated radiation therapy and concurrent chemotherapy, which was well-tolerated and resulted in complete tumor remission after three months of follow-up. Our findings suggest that this treatment approach may be effective for treating cardiac oligometastasis after oesophageal cancer surgery. Early detection and timely treatment may improve patient outcomes.

Keywords: *Esophagus; Heart; Neoplasms; Radiotherapy*

INTRODUCTION

Cardiac metastasis of oesophageal cancer is rare and there is no standard treatment available [1]. In a case report, a patient with cardiac metastasis after the resection of oesophageal cancer was successfully treated with concurrent chemoradiotherapy using helical tomotherapy.

CASE REPORT

A 48-year-old man was referred to our department for evaluation and treatment of a myocardial tumor six months after the resection of squamous cell carcinoma (pT3 N1 M0, Stage IIIB, AJCC, 8th ed.) of the middle thoracic esophagus. The patient was treated with neoadjuvant chemotherapy consisting of cisplatin and 5-fluorouracil, followed by surgical resection and three-field lymph node dissection. The postoperative course was uneventful, but due to an elevated serum squamous cell carcinoma (SCC) antigen level (6.5 ng/ml, normal < 1.5 ng/ml), whole-body contrast-enhanced computed tomography (CT) was performed, revealing a homogeneous hypodense mass in the lateral wall of the left ventricle (Fig. 1a-c). Ultrasound cardiography showed a 22.6 x 16.3 mm isoechoic irregular mass in the lateral wall of the left ventricle (Fig. 1d). The tumor was primarily located in the endocardium and did not extend beyond half of the myocardium (Fig. 1e). MRI showed no continuity between the cardiac tumor and the tumor bed or retrosternal oesophageal reconstruction site (Fig. 1f). Whole-body positron emission tomography (PET)/CT demonstrated a lesion with moderate 2-[18F]fluoro-2-deoxy-d-glucose (FDG) uptake in the left ventricle (Fig. 1g). The maximum standardized uptake value (SUVmax) was 4.5 after 1 hour, increasing to 5.3

Received: 2023-05-04 **Accepted revised version: 2023-12-31** **Published: 2023-12-31**

after 2 hours. There was no abnormal FDG uptake other than the cardiac tumor. Based on serum SCC levels and imaging findings, the patient was diagnosed with cardiac metastasis from oesophageal cancer. Since the metastasis was oligometastatic and there was a risk of fatal cardiac complications, concurrent chemoradiotherapy was performed.

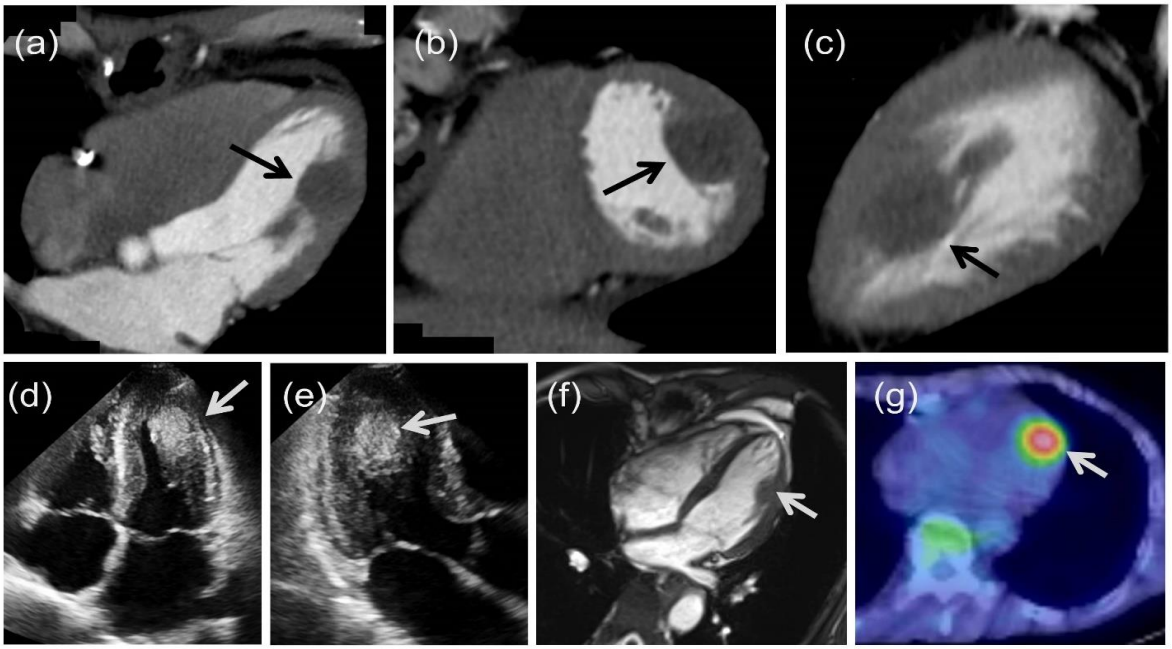

Figure 1. Imaging findings of cardiac metastasis of oesophageal cancer.
*(**a**-**c**) Contrast-enhanced CT. Transverse, coronal, and sagittal images, respectively. A homogeneous hypodense mass can be seen in the lateral wall of the left ventricle (arrows). (**d**) Transthoracic echocardiogram (apical 4-chamber) demonstrating a solitary, well-demarcated, hyperechoic mass (arrow) in the lateral wall of the left ventricle. (**e**) The parasternal short axis view shows that the tumor (arrow) is located primarily in the endocardium and does not extend beyond half of the myocardium. (**f**) True fast imaging with steady precession showed no continuity between the cardiac tumor (arrow) and the tumor bed or retrosternal oesophageal reconstruction site. (**g**) Positron emission tomography / CT obtained 2 hours after injection of 2-[18F] fluoro-2-deoxy-d-glucose revealed a hypermetabolic lesion in the lateral wall of the left ventricle (arrow).*

The study adhered to the ethical standards set by the institutional and national research committee, including the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. While institutional review board approval was waived due to approval by the Ministry of Health, Labor, and Welfare, informed consent was obtained from the patient to use their clinical data.

Target volume delineation

To prevent radiation damage to surrounding normal tissue and the myocardium, helical tomotherapy (Hi·Art® treatment system, Madison, Wisconsin, USA) was used in lieu of radiation therapy, since the patient had no history of radiation therapy. The patient underwent non-contrast and contrast-enhanced CT in the supine position to plan for radiation treatment. Transverse expiratory-phase non-contrast CT scans (Discovery HD750 CT Scanner, GE, Boston, MA, USA) were used for dose calculation, and the slice thickness was reconstructed to 2.5 mm. Five image datasets, corresponding to five phases of a breathing cycle (0% to 80% by 20% increments, with 0% representing peak inspiration), were constructed after identifying the peaks of the breath waveform. Contrast-enhanced CT was used to delineate the gross tumor volume (GTV), while the internal target volume (ITV) was created by combining the GTVs in the 5-phase images of the

4DCT sets. A planned target volume (PTV) was then created by adding a 3 mm 3-dimensional margin to the ITV while avoiding the coronary arteries.

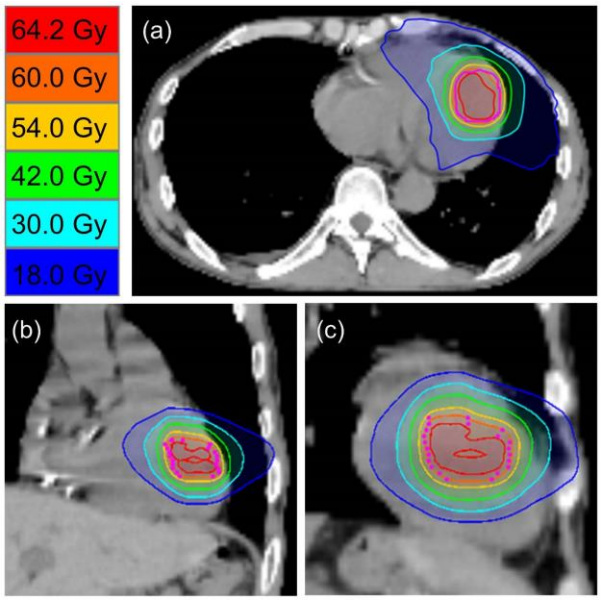

Figure 2. Radiation therapy isodose lines with corresponding actual radiation dose.
(a) Transverse (b) Coronal (c) Sagittal

Dose prescription

The patient underwent rotational intensity-modulated radiation therapy (IMRT) using helical tomotherapy. The prescribed dose was 60 Gy in 30 fractions for PTV (Fig. 2), with the dose defined as the minimum dose received by 95% volume (D95%). There was no limit set on the maximum dose for PTV. D0.1ml (the top dose delivered to a 0.1-ml volume) of the coronary arteries was set to be less than 60 Gy in 30 fractions. IMRT was performed in 30 daily fractions over a period of 6 weeks. Concurrently, docetaxel 60 mg/m^2/day and nedaplatin 80 mg/m^2/day were administered every 3 weeks and repeated until tumor progression.

Short-term Treatment Outcome

The patient received IMRT as scheduled without experiencing any radiation-induced adverse events during treatment or the 3-month follow-up period. Three months after IMRT, contrast-enhanced CT revealed that the cardiac tumor had disappeared and serum SCC levels had normalized to 1.0 ng/ml.

DISCUSSION

Cardiac metastasis from oesophageal cancer is a rare condition, and treatment options may depend on several factors, including the extent and location of the metastasis, the patient's overall health, and the presence of other metastatic sites [2-5]. For patients with oligometastases without serious complications, curative treatment may prolong survival, as has been suggested for other malignancies such as non-small cell lung cancer [6] and prostate cancer [7]. In addition, cardiac metastases are reported to have a poor prognosis [8], so curative treatment should be considered, especially if the number of metastases is small (e.g., oligometastases). To our knowledge, this is the first report of concurrent chemoradiotherapy for cardiac metastases from oesophageal cancer.

This case report has several strengths. First, multimodal imaging findings were useful in diagnosing cardiac metastasis of oesophageal cancer, allowing curative treatment without invasive tests such as biopsy or surgery. Since cardiac metastasis is a serious condition, noninvasive testing and less invasive treatment should be prioritized. Second, this is the first report to show that a single metastasis to the heart after resection of oesophageal cancer is not an uncontrollable lethal condition but is potentially treatable. If the recurrence after resection of oesophageal cancer is oligometastasis in the heart, and if the patient is in good general condition, concurrent chemoradiotherapy for cardiac metastases may be effective.

This case report has several limitations. First, RTP could not synchronize both cardiac and respiratory movements. MRI-guided radiotherapy systems have the potential to provide more accurate radiation delivery by visualizing cardiac lesions in real time and continuously monitoring their anatomical location while delivering radiation therapy [9,10]. Second, the follow-up period after chemoradiotherapy is as short as 3 months. However, a 3-month follow-up was considered sufficient to evaluate acute adverse events during

and immediately after chemoradiotherapy and to assess short-term treatment efficacy.

CONCLUSION

Although one case report cannot be generalized to other cases without further scientific verification, oligometastasis to the heart after oesophageal cancer resection may be treatable with concurrent chemoradiation.

Author declaration

Authors' contributions:
Study concept and design: Y.H., and E.T.; Acquisition of data: Y.H., and E.T.; Analysis and interpretation of data: Y.H., and E.T.; Drafting of the manuscript: Y.H., and E.T.; Critical revision of the manuscript for important intellectual content: Y.H., and E.T.; Administrative, technical, and material support: Y.H.; Study supervision: Y.H.

Conflicts of interest:
The authors declare that there is no financial or non-financial conflict of interest.

Funding statement:
Self-funded

Ethics statement:
Written informed consent was obtained for participation and publication.

Statement on data availability:
The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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