CASE REPORT

Lu-177 labelled peptide treatment for radioiodine refractory differentiated thyroid carcinoma

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SUMMARY

Differentiated thyroid carcinoma (DTC) has good prognosis but 5% of the patients already have distant metastasis at the diagnosis. Tumour cells can lose their iodine uptake ability and enter a state of dedifferentiation. Treatment for differentiated thyroid carcinoma that is not suitable for the local surgery and unresponsive to radioactive iodine uptake is not always easy for physicians. We present a case of a 64-year-old man who had total thyroidectomy surgery and central lymph node dissection with diagnosis of multinodular

goitre disease. Histopathological evaluation was papillary thyroid cancer with tall cell variant. Treatment using 150 mCi radioiodine was administered to the patient three times but could not effect a cure. We performed Ga-68 labelled DOTATE (synthetic somatostatin analogue peptide). This provided a good outcome. As evident from our case, Lu-177 radionuclide labelled synthetic somatostatin analogue peptides have therapeutic effect on radioiodine refractory DTC, as an alternative treatment modality.

Figure 1 Widespread hypermetabolic soft tissue lesions detected in both lungs, with fluorodeoxyglucose positron emission tomography CT.

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BACKGROUND

Lu-177 radionuclide labelled synthetic somatostatin analogue peptides have therapeutic effect in fighting radioiodine refractory differentiated thyroid carcinoma (DTC) as an alternative treatment modality.

CASE PRESENTATION

A 64-year-old man underwent total thyroidectomy surgery and central lymph node dissection with diagnosis of multinodular goitre disease. Histopathological evaluation was papillary thyroid cancer with tall cell variant, 2.5 cm in diameter, left cervical lymph node positivity and no vascular invasion. Treatment using 150 mCi radioactive iodine was administered to the patient. I-131 uptake was detected on the left cervical area during the post-treatment iodine scanning evaluation. Thyroid-stimulating hormone (TSH) level was 100 IU/mL, thyroglobulin (Tg) was normal and antithyroglobulin (anti-Tg) was negative. On the follow-up, the patient's Tg levels increased. Therefore, 150 mCi radioiodine treatment was administered three times. After radioiodine administration, there was no detectable iodine uptake. However, several months later, the patient's Tg level was detected at 609 ng/mL while his anti-Tg level was normal. At this time patient also developed a cough, dyspnoea and haemoptysis. Whole body screening with fluorodeoxyglucose positron emission tomography (FDG PET/CT) was performed. Widespread hypermetabolic soft tissue lesions were detected in both lungs (figure 1). Owing to intensive FDG uptake, dedifferentiate transformation of thyroid carcinoma was

considered. Tyrosine kinase inhibitor (TKI) treatment was administered for dedifferentiated thyroid carcinoma. On follow-up, hand-foot syndrome and several TKI-induced side effects were found to have occurred. For these reasons, TKI treatment was stopped. After undergoing all these processes, the patient consulted with the nuclear medicine department for an alternative treatment modality.

TREATMENT

We performed Ga-68 labelled DOTATE (synthetic somatostatin analogue peptide) and somatostatin receptor expression was detected on subcarinal lymph node, left second lateral rib, left iliacus posterior, right pubis anterior and lungs. The existence of a somatostatin receptor led us to consider that Lu-177 labelled DOTATE (synthetic somatostatin analogue peptide) could be used as alternative treatment (figure 2).

OUTCOME AND FOLLOW-UP

Before initiating the Lu-177 treatment, we performed renal function blood tests. The patient's renal function was in the normal range. Infusion of 200 mCi Lu-177 labelled DOTATE was carried out. We detected somatostatin receptor expressions on the mediastinum and both lungs 24 h after the infusion. Therefore, we confirmed that the lesions were metastatic lesions (figure 3). After administration of the second Lu-177 treatment, the patient's thyroid tests were TSH: 0.04 IU/mL, Tg: 9 ng/mL and anti-Tg normal with the suppression of l-thyroxine. As evident from our case, Lu-177 radionuclide labelled synthetic

Figure 2 Ga-68 labelled DOTATE screening with positron emission tomography CT (synthetic somatostatin analogue peptide) and somatostatin receptor expression detected on subcarinal lymph node, left second lateral rib, left iliacus posterior, right pubis anterior and lungs.

Figure 3 Detection of somatostatin receptor expression 24 h after Lu-177 infusion on mediastinum and lungs.

somatostatin analogue peptides have a therapeutic effect on radioiodine refractory DTC as an alternative treatment modality.

DISCUSSION

DTC has good prognosis but 5% of the patients already have distant metastasis at the diagnosis.¹ Treatment for differentiated thyroid carcinoma that is not suitable for the local surgery and unresponsive to radioactive iodine uptake is not always easy for physicians. Tumour cells could lose their iodine uptake ability and enter a state of dedifferentiation.^{2–3} In such cases, TKIs are widely used for advanced DTC, but TKIs are not specific for only one kind of tyrosine kinase. Besides, TKIs have several side effects for many organ systems.⁴ In recent years, somatostatin receptors have been detected on various endocrine glands. Therefore, Ga-68 radionuclide labelled synthetic somatostatin analogues have, since 2005, been commonly used on PET screening, for detecting endocrine-based tumours.⁵ Lu-177 radionuclide labelled synthetic somatostatin analogues have recently been used widely in nuclear medicine treatment practice. Owing to limited treatment options with unresponsive radioactive iodine uptake in patients with DTC, Lu-177 is considered an alternative treatment modality.⁶ As evident from our

case, Lu-177 radionuclide labelled synthetic somatostatin analogue peptides have therapeutic effect on radioiodine refractory DTC as an alternative treatment modality.

Learning points

- ▶ Metastases of DTC can be unresponsive to radioiodine treatment due to dedifferentiation.
- ▶ Tyrosine kinase inhibitors have been used widely for advanced differentiated thyroid carcinoma (DTC), but side effect occurrence is a problem.
- ▶ Lu-177 radionuclide labelled synthetic somatostatin analogue peptides have a therapeutic effect in fighting radioiodine refractory DTC as an alternative treatment modality.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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