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Implementation of dosimetry in clinical Lu177-DOTATATE therapy

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BACKGROUND

While generally well tolerated, Lu-177 DOTATATE therapy can result in adverse effects such as renal toxicity or myelosuppression. Because of this, our institution has implemented post-therapy dosimetry for specific patients at risk of receiving elevated normal-tissue dose. Despite the fact that radiation dose is the mechanism for cytotoxic effects, clinical implementation of dosimetry is challenging due to a lack of validated tolerance dose limits for radiopharmaceutical therapy.

This abstract summarizes our experience incorporating dosimetry into clinical Lu-177 DOTATATE therapy.

METHODS

To date, dosimetry was performed on four patients due to: re-treatment (n=2), single kidney (n=1), and poor kidney function (n=1). Post-therapy dosimetry was performed using quantitative SPECT/CT acquired 4, 24, 48, and 72 hrs post-injection. Absorbed dose to kidneys, lungs, liver, and representative regions of bone marrow was calculated using voxel-based dosimetry (MIM Software Inc., Cleveland, OH). Single-cycle absorbed dose was extrapolated to estimate total dose from multiple cycles and compared to tolerance dose limits used in EBRT or other therapies.

RESULTS

Reference dose limits and mean dose per injected activity for each patient are shown in Table 1. Of the four patients, two potentially exceeded the limits.

Patient 1 was a re-treatment case who received an additional 2 cycles based on a bone marrow dose of 3.1 Gy and kidney dose of 22.4 Gy.

Patient 4 had poor kidney function and was therefore treated with 50% activity (3.7 GBq). Based on dosimetry, the patient was protocoled to receive a maximum of 4 cycles of 50% activity. Ultimately, cycle 2 was reduced by another 50% (1.9 GBq) due to grade 3 thrombocytopenia, and cycle 3 was postponed due to grade 3 anemia.

	Gy/GBq		
	Liver (<30 Gy)	Bone Marrow (<2 Gy)	Kidneys (<23 Gy)
1 - retreatment	0.205	0.069*	0.505*
2 - retreatment	0.133	0.037	0.460
3 - single kidney	0.109	0.025	0.729
4 – low kidney function	0.109	0.175*	1.638*

CONCLUSIONS

Because there are no well-established normal organ dose limits for Lu-DOTATATE, the dosimetry results are always considered along with other clinical factors. When dosimetry suggests low normal tissue doses, we are given confidence to proceed with the maximally approved activity per cycle. However, when normal organ doses exceed limits, we carefully consider the overall clinical scenario before change in management.

This preliminary data is limited to a single institution and more information from larger studies and long-term follow up is needed to establish generalizable recommendations for clinical implementation of dosimetry in radiopharmaceutical therapy.

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