99mTc-MAA Overestimates the Absorbed Dose to the Lungs in Radioembolisation: A Quantitative Evaluation in Patients Treated with 166Ho Microspheres

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Background

- Radiation pneumonitis is a rare but serious complication of embolisation of liver tumors

- Estimation of the mean absorbed dose to the lungs based on pre-treatment diagnostic Technetium 99mTc macro aggregated albumin (Tc-99m-MAA) imaging, has not been evaluated compared to pre-treatment diagnostic 166-Holmium (166-Ho)
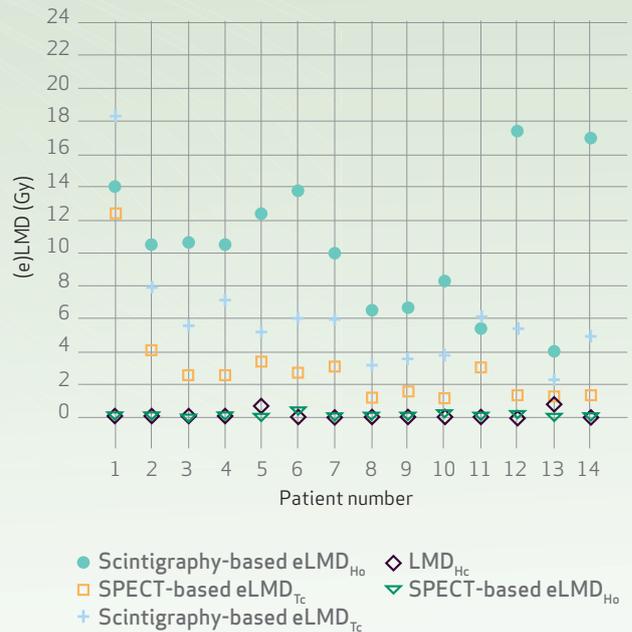
Objective

To compare the performance of pretreatment diagnostic Tc-99m-MAA imaging and pretreatment diagnostic 166-Ho microsphere imaging for lung absorbed dose estimating in 166-Ho radioembolisation.

Methods

- A prospective clinical study included 14 patients with chemorefractory, unresectable liver metastases treated with 166-Ho radioembolisation

- Tc-99m-MAA-based and 166-Ho microsphere-based estimation of lung absorbed doses was performed on pre-treatment diagnostic planar scintigraphy and SPECT/CT images

- The clinical analysis was preceded by an anthropomorphic torso phantom study with simulated lung shunt fractions of 0 to 30 % to determine the accuracy of the image-based lung absorbed dose estimates after 166-Ho radioembolisation

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Results

- Mean dose of 166-Ho scout dose was 250MBq

- The median actual lung absorbed dose was 0.02 Gy, based on post-treatment imaging

- Lung absorbed doses estimated on the basis of pre-treatment diagnostic 166-Ho microsphere imaging were better predictors of actual lung absorbed dose than Tc-99m-MAA based imaging

- Lung absorbed doses estimated using SPECT CT were more accurate than estimations based on planar scintigraphy

Legend:
- ● Scintigraphy-based eLMD$_{Ho}$
- ◇ LMD$_{Hc}$
- □ SPECT-based eLMD$_{Tc}$
- ▽ SPECT-based eLMD$_{Ho}$
- + Scintigraphy-based eLMD$_{Tc}$

Axes: y-axis = (e)LMD (Gy); x-axis = Patient number

CONCLUSION

This study shows that Tc-99m-MAA pre-treatment imaging overestimates the lung absorbed dose, expected in 166-Ho radioembolisation.

Key Takeaway

- The 166-Ho scout dose has been shown to be **more accurate** than the commonly used surrogate Tc-99m-MAA at **predicting lung shunting**

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