

## Kinetics of $^{111}\text{In}$ -labeled bleomycin in patients with brain tumors: Compartmental vs. non-compartmental models

Päivi M. RYYNÄNEN,\*<sup>1</sup> Sauli E. SAVOLAINEN,\*<sup>1,2</sup> Hannu J. ARONEN,\*<sup>2,3</sup> E. Tapani KORPPI-TOMMOLA,\*<sup>2</sup>  
Helena M. HUHMAR,\*<sup>4</sup> Merja E. KALLIO\*<sup>4</sup> and Jukka V. HILTUNEN\*<sup>5</sup>

\*<sup>1</sup>Department of Physics, University of Helsinki, Finland

\*<sup>2</sup>Department of Radiology, Helsinki University Central Hospital, Finland

\*<sup>3</sup>Department of Clinical Radiology, Kuopio University Hospital, Finland

\*<sup>4</sup>Department of Neurology, Helsinki University Central Hospital, Finland

\*<sup>5</sup>MAP Medical Technologies Ltd., Finland

The kinetics of an indium-111 labeled bleomycin complex ( $^{111}\text{In}$ -BLMC) after rapid intravenous injection in patients with brain tumors was quantified by using compartmental and non-compartmental models. The models were applied to data obtained from 10 glioma, one meningioma, and one adenocarcinoma brain metastasis patients. Blood and urine samples from all the patients and tumor samples from three patients were collected. The mean transit time of  $^{111}\text{In}$ -BLMC in the plasma pool was  $14 \pm 7$  min without and  $1.8 \pm 0.6$  h when accounting for recirculation, and  $13 \pm 4$  h in the total body pool. The mean plasma clearance of  $^{111}\text{In}$ -BLMC was  $0.3 \pm 0.1$  ml blood/min and the mean half-life in urine was  $3.5 \pm 0.6$  h. The mean transfer coefficients for the open three-compartmental model were: excretion from plasma =  $0.02 \pm 0.01$ , from depot to plasma =  $(12 \pm 9) \cdot 10^{-4}$ , from plasma to depot =  $0.01 \pm 0.01$ , from tumor to plasma =  $0.39 \pm 0.19$  and from plasma to tumor =  $1.11 \pm 0.57$ , all in units  $\text{minute}^{-1}$ . The mean turnover time from the tumor was  $4.5 \pm 2.7$  min and from the depot  $20 \pm 8$  h. It is concluded that both compartmental and non-compartmental models are sufficient to describe the kinetics of indium-111 labeled bleomycin complex. The non-compartmental model is more practical and to some extent more efficient in describing the *in vivo* behaviors of  $^{111}\text{In}$ -BLMC than the compartmental model. The compartmental model used provides estimates of both extraction and excretion from the plasma and tumor.

**Key words:**  $^{111}\text{In}$ -bleomycin, brain tumors, modeling, compartmental models, exponential fit