Kinetic modelling of [^{68}Ga]Ga-DOTA-Siglec-9 in a porcine infection model

Lars Jødal[1] • Anne Roivainen[2] • Vesa Oikonen[2] • Sirpa Jalkanen[3] • Søren B. Hansen[4] • Pia Afzelius[5] • Aage K.O. Alstrup[4] • Ole L. Nielsen[6] • Svend B. Jensen[1,7]

1. Department of Nuclear Medicine, Aalborg University Hospital, Aalborg, Denmark
2. Turku PET Centre, Turku University Hospital, Turku, Finland
3. MediCity Research Laboratory and Department of Medical Microbiology and Immunology, University of Turku, Turku, Finland
4. Department of Nuclear Medicine and PET Centre, Aarhus University Hospital, Aarhus, Denmark
5. Department of Diagnostic Imaging, North Zealand Hospital, Hillerød, Copenhagen University Hospital, Denmark
6. Department of Veterinary and Animal Sciences, University of Copenhagen, Copenhagen, Denmark
7. Department of Chemistry and Biosciences, Aalborg University, Aalborg, Denmark

Background

- Localized infections in the body can be hard to diagnose.
- Positron emission tomography (PET) can visualize physiological processes inside the body, but requires suitable tracers.
- The PET tracer [^{68}Ga]Ga-DOTA-Siglec-9 is a candidate for infection scanning, as Siglec-9 binds to a protein involved in leukocyte extravasation.
- Uptake has been demonstrated in several studies, but kinetic studies are lacking.

Aim

To investigate and model the kinetics of [^{68}Ga]Ga-DOTA-Siglec-9 in infection.

Material and methods

Eight female juvenile domestic pigs (Danish Landrace x Yorkshire breed; 19-25 kg) were during anaesthesia inoculated with *Staphylococcus aureus* in the right femoral artery to cause specific infection of the right hind limb. Pigs with signs of osteomyelitis after one week were dynamically PET/CT scanned with [^{68}Ga]Ga-DOTA-Siglec-9, along with blood sampling. After scanning, the pigs were euthanized and necropsied. Volumes of interest (VOIs) were drawn on the PET/CT scans at identified infection foci and compared with corresponding VOIs in the non-infected left hind limb (**Fig. 1**).

PET data were kinetically modelled with three different compartment models, see **Fig. 2**. Patlak and Logan plots were also investigated. For the reversible models, distribution volume was calculated from model data.

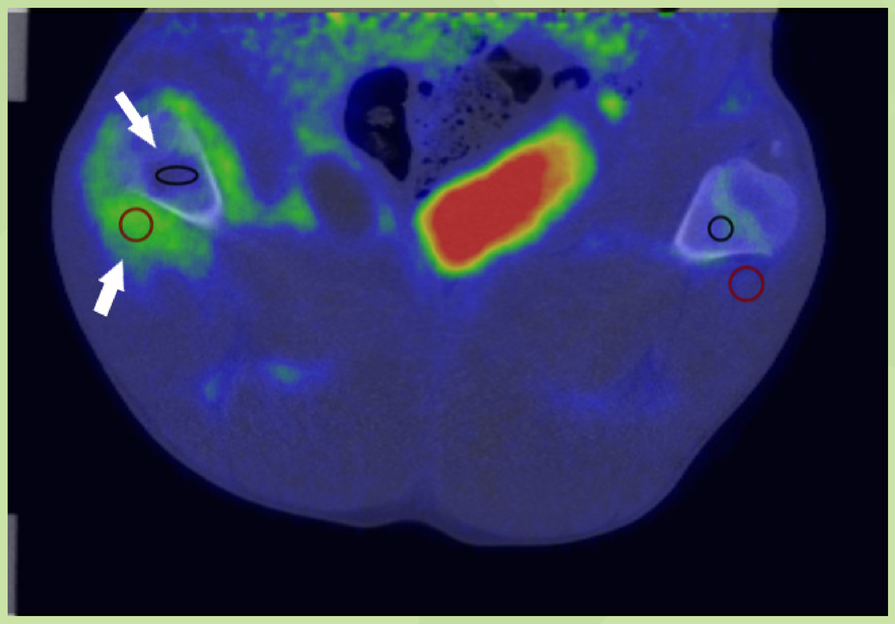

Fig. 1: Coronal PET/CT image of pig with VOIs. In right hind limb, the black VOI is drawn in osteomyelitis area, the red VOI within a soft tissue infection (see arrows). The prominent red area is bladder uptake and not related to infection.

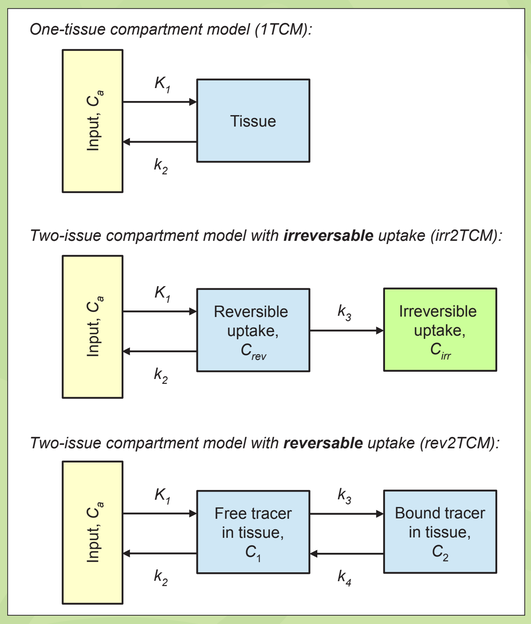

Fig. 2: Compartment models used in modelling of tracer uptake.

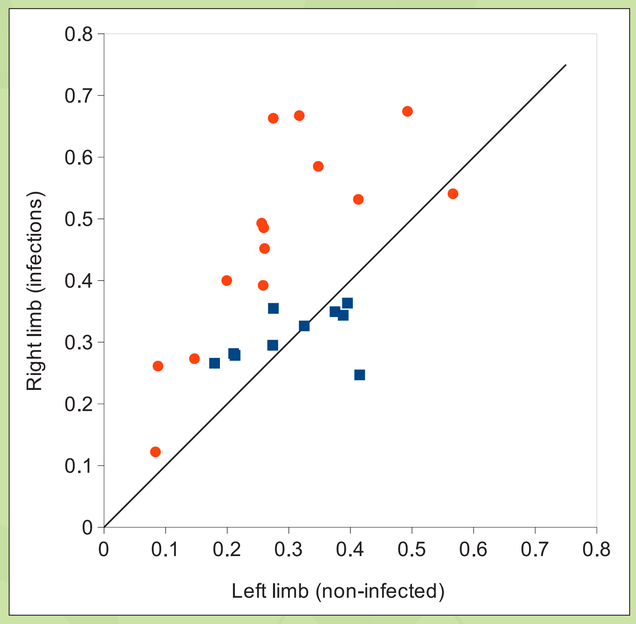

Fig. 3: Distribution volume (DV), compared between infected (right limb) and corresponding non-infected (left limb) tissue. Blue squares are in bone (osteomyelitis sites), red circles are in soft tissue infections. The line represents equal DV in left and right (y=x).

Results

- 10 bone infections and 12 soft tissue infections studied.
- Most data sets required the rev2TCM model for fitting.
- Linear Logan plots and non-linear Patlak plots also indicated reversible uptake.
- Distribution volume (DV) for [^{68}Ga]Ga-DOTA-Siglec-9 was significantly elevated in soft tissue infections, but not in bone infections (**Fig. 3**).

Conclusions

[^{68}Ga]Ga-DOTA-Siglec-9 has reversible kinetics, which can be modelled with the rev2TCM (4 k-parameters, see **Fig. 2**). Distribution volume was only elevated in soft tissue infections. The tracer seems to be relevant for identifying soft tissue infections, but not osteomyelitis.

Contact
Lars Jødal
e-mail: lajo@rn.dk

AALBORG UNIVERSITY HOSPITAL Denmark
NMA Nuclear Medicine Aalborg
REGION H
Nordsjællands Hospital
Turku PET
Aarhus Universitetshospital