Investigation of the Aluminium Biokinetics in Rats Using ^{26}Al

C. Steinhausen , G. Kislinger , E. Nolte, and T.H. Ittel [a]
[a] Medical Clinic II, RWTH Aachen, D-52057 Aachen, Germany

The radioisotope ^{26}Al was used as a tracer to investigate the aluminium biokinetics in rats. The ^{26}Al contents in different tissue, serum and urine samples were measured by accelerator mass spectrometry as described on page 74. Two studies were performed.

1. Oral application

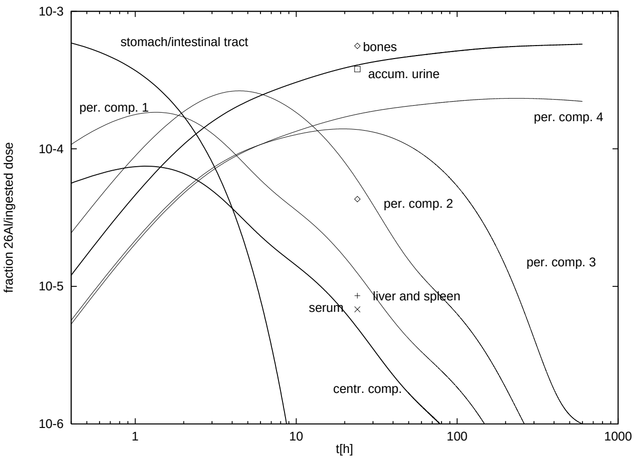

Fig. 1: ^{26}Al in blood serum, urine, bone, liver and spleen. The caculated curves represent the content in the central and peripheral compartments and the urine.

In the first study, 20 ng ofof ^{26}Al were administered orally to 12 Sprague-Dawley rats. Six of them were controls. Renal failure was induced by 5/6 nephrectomy to another six animals. Samples of blood serum, urine, trabecular bone, liver and spleen were taken 24 h after application. The aim of this study was to investigate differences between healthy and nephrectomized animals in gastrointestinal resorption, compartmentalization and elimination. The serum concentrations of ^{26}Al were lower in uremic rats as compared to controls, whereas urinary excretion was comparable suggesting a higher fraction of ultra-filtrable serum ^{26}Al in uremia. Fig. 1 shows the ^{26}Al content in blood serum, urine, bone, liver and spleen divided by the applied amount of ^{26}Al. Additionally, calculated curves representing the single compartments are shown.

2. Intravenous Application

In the second study, 0.2 ng of ^{26}Al were applied intravenously to 15 controls and 15 uremic rats. The rats were sacrificed at different times of 1, 5, 24, 125, 625 and 3000 hours after administrating the ^{26}Al. Tissue samples of blood serum, urine, trabecular bone, liver, spleen and muscle were taken.

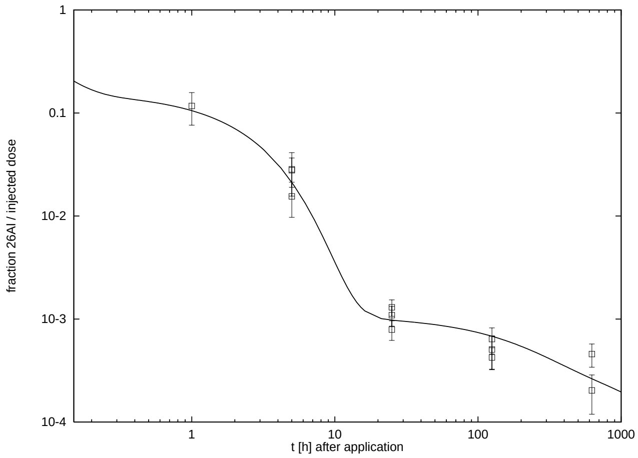

Fig. 2: ^{26}Al in blood serum after intraveneous application. The curve is calculated by an open compartment model.

The aim of this study was to measure ^{26}Al in all important organs of the rats as function of time, to establish a compartment model simulating the aluminium kinetics in the body, and to assign the model compartments to organs and tissues. This model is to determine rate constants between organs or compartments. The blood serum samples were already measured by AMS. In Fig. 2 the results are shown. An open compartment model consisting of a central compartment representing the blood serum and four peripheral compartments was developed which is able to describe the aluminium biokinetics in rats. The model is described on page 74. Time curves of aluminium concentrations in rats cannot be obtained simply by scaling down the time curves of human subjects [1]. The compartment model was applied to the present studies and to [2–4]. The model is able to describe the measurements. Time constants are derived.

References

[1] C. Steinhausen et al. Nucl.Instr.Meth. **B 5754** (1996) 1-5.
[2] O. Meirav et al. Am.J.Physiol. **260** (1991) F466-F469
[3] R. Sutton et al. J.Am.Soc.Nephrol. **2** (1991) abstract
[4] P. Jouhanneau et al. Clinical Chem. (1995) in press