EVALUATION OF ^{153}SAMARIUM CHLORIDE IN MICE:BIODISTRIBUTION STUDIES

Helena Okada, Emiko Muramoto, Haroldo T. Gasiglia

Instituto de Pesquisas Energéticas e Nucleares (IPEN/CNEN-SP)
Caixa Postal 11049. CEP 05422-970. São Paulo/SP. Brasil

Interest in employing beta-emitting radiopharmaceuticals for diagnosis and therapy of cancer has reached widespread clinical acceptance with Sm-153 ethylenediaminetetramethylene phosphonic acid [^{153}Sm-EDTMP]. [^{153}Sm-EDTMP] has been proposed as bone seeking radiopharmaceutical for palliation of bone pain from metastatic bone cancer.

^{153}Sm was obtained from Sm_2O_3 by neutron irradiation at the tracer level. It has produced at the IPEN/CNEN-SP Research Reactor using a thermal flux of 1.0×10^{13} n/cm^2 . sec for 8 hrs.

The aim of this study was to assess the preferential localization of ^{153}Sm in the mice organs to evaluate ^{153}Sm unbound from the appropriate carriers after *in vivo* administration.

MATERIAL AND METHODS

- Preparation of ^{153}Sm chloride

A weighed amount of natural Sm_2O_3 was flame sealed into a quartz vial under vacuum and welded into an aluminum can. Following neutron irradiation the sample was opened, dissolved in 0.1N HCl by heating and magnetic stirring. The sample was counted after several half-lives decay ($T_{\frac{1}{2}}$= 46.7hr) without chemical separation to determine the energy scanning. ^{153}Sm has favourable characteristics for imaging with a principal gamma emission energy 0.103 MeV (28%). The other 58 gammas are in the energy range 0.041-0.764 MeV and are all below 0.6% abundant. The mean beta emission of ^{153}Sm is 0.227 MeV (100%). Before using as tracer in the mice, the radiochemical purity was verified by PEI-cellulose chromatographic system using the mixture of pyridine:ethanol:water (1:2:4,v/v/v) as mobile phase (purity=99,9%)

- Biodistribution study.

The biodistribution was performed by injecting from 100 to 400 µl of $^{153}SmCl_3$ into the tail vein of unanesthetized female Swiss mice with the age of 2 months. At 3, 24, 48, 72 hr post-injection, groups of mice were weighed, 100 µl of blood were taken by retro-orbital puncture from each one and the animals were killed. Selected organs were then excised, washed with water, blotted and weighed. One femur was excised and dissected free of the soft tissues before weighing and counting. It was used to estimate the reactivity associated with the skeleton. All tissues after the dissection were counted in a NaI(Tl) well

detector and compared with diluted standard minus the injection site counts. The blood pool was assumed to be 7% of the total body weight, the skeleton to be 10% and the muscle to be 40%. The data from the biodistribution were computed as per cent injected dose/organ.

RESULTS AND DISCUSSION

ORGAN	3hr (n = 6)	24hr (n = 7)	48hr (n = 7)	72hr (n = 7)
Heart	0.20±0.04	0.07±0.02	0.06±0.02	0.05±0.01
Lungs	1.11±0.15	0.66±0.31	0.51±0.16	0.65±0.18
Kidneys	0.79±0.19	0.70±0.21	0.32±0.11	0.27±0.07
Liver	37.09±3.80	32.35±1.72	31.68±0.53	32.49±0.92
Spleen	1.69±0.19	3.89±0.99	6.20±1.26	9.78±3.83
Stomack	0.23±0.04	0.20±0.09	0.16±0.10	0.07±0.03
Large Bowel	0.86±0.07	1.21±0.27	0.50±0.17	0.26±0.08
Small Bowel	3.09±0.58	2.80±1.09	1.18±0.57	1.05±0.47
Left leg	0.94±0.22	1.10±0.40	0.78±0.15	0.74±0.14
Head	1.43±0.37	0.98±0.30	0.93±0.32	0.74±0.16
Blood	17.64±3.49	0.37±0.32	0.04±0.01	0.03±0.02
Muscle	2.36±0.77	1.17±0.39	1.25±0.59	1.34±1.13
Skeleton	2.64±1.17	3.81±1.64	4.57±1.45	4.28±1.27
Liver/blood	2.15±0.37	58.48±50.89	696.68±141.25	1427.77±826.92
Skeleton/blood	0.15±0.78	10.74± 9.80	133.70± 11.33	191.37±123.41
Spleen/blood	0.10±0.01	10.95±10.97	175.79± 23.93	390.92±181.81

Table above shows the tissue distribution (% injected dose/organ±sd) at 3, 24. 48 and 72 hr post-injection of $^{153}SmCl_3$ into mice.

The results in Table showed that blood levels of free ^{153}Sm declined rapidly and were from 17.64±3.49 % of injected dose/organ (%ID/organ) to 0.03±0.02 %ID/organ of the activity remaining in whole blood at 3 up to 72 hr.

Organ distribution studies showed that while almost all tissues had decreased activity levels over time, others (liver, spleen, skeleton) showed marked differences. The highest radioactivity was taken up by liver and the level, about 37 %ID/organ, was maintained unchanged for the 72 hrs experimental period. As the blood activity cleared, the liver/blood ratio increased up to 1427.77±826.92 at 72 postinjection.

Otherwise, the experimental evidence indicates that spleen uptake rose over progressively and skeleton uptake was higher at 48 and 72 hr than at 3 hr after injection.