The Royal Liverpool and Broadgreen University Hospitals NHS Trust

In-patients Receiving ^{90}Y-Dotatoc / Dotatate Therapy: Dose Rate Analysis & Advice

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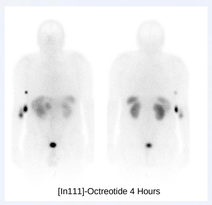
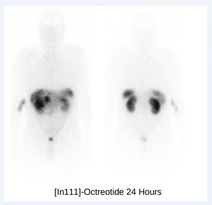
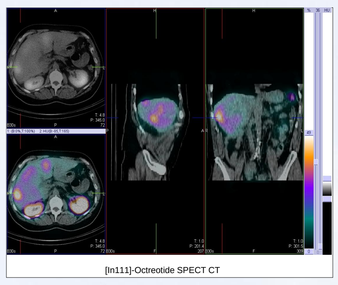
Introduction

[^{90}Y]-DOTATOC / DOTATATE Therapy Protocol:
Suitable patients: positive [^{111}In]-Octreotide scan followed by [^{111}In]-Dotatoc / Dotatate diagnostic images at 4 and 24 hours ± SPECT-CT. If pronounced focal uptake is observed patient may be offered [^{90}Y]-Dotatoc / Dotatate Therapy *e.g.*

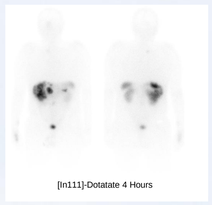

[In111]-Octreotide 4 Hours

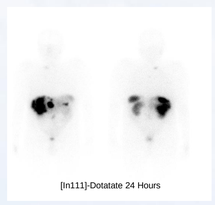

[In111]-Octreotide 24 Hours

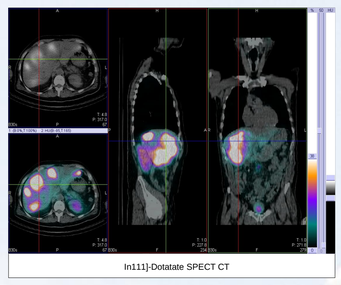

[In111]-Octreotide SPECT CT

111 MBq [In111]-Octreotide

Several sites of abnormal functioning neuroendocrine tissue bearing somatostatin receptors in the liver.

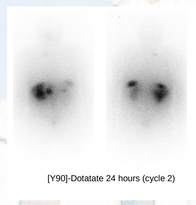

[In111]-Dotatate 4 Hours

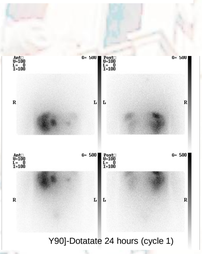

[In111]-Dotatate 24 Hours

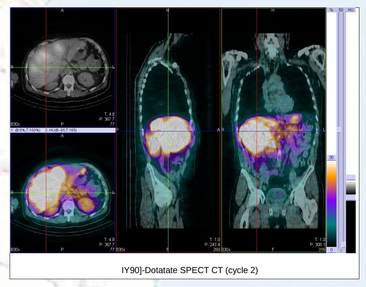

In111]-Dotatate SPECT CT

111 MBq [In111]-Dotatate

Several foci of somatostatin receptor expressing tumour deposits noted in the liver.


[Y90]-Dotatate 24 hours (cycle 2)


Y90]-Dotatate 24 hours (cycle 1)


IY90]-Dotatate SPECT CT (cycle 2)

5 GBq [Y90]-Dotatate

The scan shows significant localisation of radiotracer in the known neuroendocrine tumour deposits.

Objective

At present patients receiving ^{90}Y-Dotatoc / Dotatate for cancers expressing somatostatin receptors are treated as an inpatient procedure being discharged at around 45 hours post treatment (two nights stay). The patients occupy a single room (a disposable floor lining is laid) and after imaging are free to go home. A sheet outlining instructions (obeyed for the following 3 days post discharge is given to the patient).

A dose rate assessment has been undertaken to determine if this period can be reduced thereby benefiting the patient and freeing up a single occupancy room sooner for use.

Method

Dose rate (DR) measurements were taken on thirteen patients (12M : 1F). Administered activities ranged Between 4860 - 5200 MBq with an average of 5060 MBq (it should be noted that on 3 occasions patients receiving MIBG therapy were located next door, however this was deemed to have little effect on the measurements). Dose rates were recorded at distances of 0.5 and 1.0 m from each patient on right and left hand side at various times up to 48 hours post therapy.

Table 1.0 details averaged measured DR at 1.0 m for various times post therapy and the max-to-min range of values.

Results

Graphs 1.0 and 1.1 show the measured dose rates at 1.0 m from the right and left hand sides respectively as a function of time. Average measured dose rates at 1.0 m (max-to-min ranges) immediately after therapy were 7.2 (20-3) and 8.2 (20-4) for right and left hand sides respectively. At 24 hours dose rates were 1.5 (4-1) and 1.5 (3-1) for right and left hand sides respectively. A single exponential decay model was fitted to the data to give calculated dose rates as a function of time.

Using this model, calculated dose rates were obtained at 6 hour intervals between t = 0 and t = 48 hours (refer to Table 1.1).

Time Post Therapy (hours)	Average measured DR RHS (μSv.hr^{-1})	Range Max-Min (μSv.hr^{-1})	Average Measured DR LHS (μSv.hr^{-1})	Range Max-Min (μSv.hr^{-1})
0 (Wed 12.00 noon)	7.2	20 - 3	8.2	20 – 4
3 – 6	6.4	15 - 2	6.3	15 – 1
20 - 24	1.6	3 - 1	1.5	3 – 1
24 +	1.5	4 - 1	1.5	3 - 1

Table 1.0: Measured average dose rates & max-min ranges as a function of time.

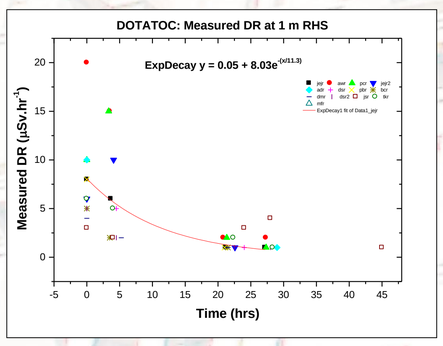


Fig 1.0: Measured DR as a function of time at 1.0 m RHS.

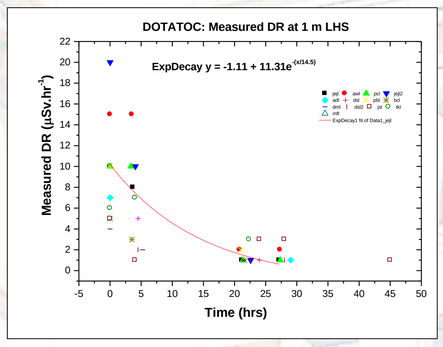


Fig 1.1: Measured DR as a function of time at 1.0 m LHS.

Time Post Therapy (hours)	Calculated DR RHS (μSv.hr^{-1})	Calculated DR LHS (μSv.hr^{-1})	Average Calculated DR (μSv.hr^{-1})
0	8.1	10.2	9.2
6	4.8	6.4	5.6
12	2.8	3.8	3.3
18	1.7	2.2	2.0
24	1.0	1.1	1.1
28	≈1	≈1	≈1
30	≈1	≈1	≈1
36	≈1	≈1	≈1
42	≈1	≈1	≈1
45	≈1	≈1	≈1
48	≈1	≈1	≈1

Table 1.1: Calculated average dose rates at various times

Conclusions

The conclusion is that at 1.0 m, both the mathematical calculation of a single exponential fit and the actual measured data indicate dose rates at levels at around 4 μSv.hr^{-1} worst case and typically 1.5 μSv.hr^{-1} or less on average at 24+ hours (By examining the data at 0.5 m by the same techniques dose rates at levels also around 4 μSv.hr^{-1} worst case and typically 1.8 μSv.hr^{-1} or less on average at 24+ hours).

With these dose rates, it is deemed acceptable for patients to leave after a minimum of 24 hours along with a amended patient instruction sheet (obeying the instructions for 4 days post discharge). A patient specific risk assessment can be carried out when an individual given "cause for concern" arises (e.g. Incontinence etc.).

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